

THE PACKING INDUSTRY

THE INSTITUTE OF AMERICAN MEAT PACKERS

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Institute of American Meat Packers

THE PACKING INDUSTRY

A SERIES OF LECTURES GIVEN UNDER
THE JOINT AUSPICES OF THE

SCHOOL OF COMMERCE AND ADMINISTRATION
OF THE UNIVERSITY OF CHICAGO

AND THE

INSTITUTE OF AMERICAN MEAT PACKERS



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PREFACE

The lectures published in this volume were delivered at the University of Chicago in February, March, and April, 1923, under the joint auspices of the School of Commerce and Administration and the Institute of American Meat Packers. They are very general both in nature and in treatment. They are not—and there is no pretension to the contrary—specialized presentations. Instead, each lecture is merely an attempt to give, in a few thousand words, a bird's-eye survey of a broad subject which would require for detailed and comprehensive treatment several volumes as large as this one.

It is true, however, that this book brings together in orderly fashion some material not before correlated in convenient form. In that sense it breaks new ground. It also furnishes a sweeping view of the packing business as a whole.

Moreover, the lectures awakened added interest in the social, physical, and business principles applied in meat packing; and, finally, they intensified and showed the interest existing in the Institute Plan.

When this series of lectures was given in Mandel Hall, there was no formal co-operation existing between the University of Chicago and the Institute of American Meat Packers. Since that time, the Institute

of Meat Packing has been organized and is functioning.

In co-operation with the University of Chicago, it will be a complete educational unit carrying on research in the sciences applied in meat packing, giving instruction by evening classes and correspondence work to men engaged in the packing industry, and offering a four-year curriculum of day courses for men intending to enter the industry. Evening classes and research have been inaugurated. Correspondence courses will be offered shortly after the beginning of the year 1924 and day courses in the fall of that year.

In connection with this progress, it is pleasant to recall that the series of lectures published in this volume marked the initial operation of the Institute Plan.

A special obligation from all those associated with this specific undertaking is due the lecturers, the Committee on Educational Plans of the Institute of American Meat Packers, and Mr. Wesley Hardenbergh, Director of the Bureau of Public Relations in that organization, who edited most of the lectures.

L. C. MARSHALL

*Dean, The School of Commerce and Administration,
University of Chicago*

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Introductory Lecture

THE INSTITUTE AND ITS DEVELOPMENT PLAN

GENERAL SURVEY OF THE SERIES

BY

THOMAS E. WILSON



THE INSTITUTE AND ITS DEVELOPMENT PLAN

I. INTRODUCTION

This series of lectures is given under the joint auspices of the University of Chicago, acting through the School of Commerce and Administration, and the Institute of American Meat Packers, acting through the Institute Plan Commission.

These lectures constitute the first effected activity under the educational division of the Institute plan. In order, therefore, that each lecture may be construed in relation to the series of which it is an integral part, I have been asked to outline briefly the ground which will be covered by the lecturers; and in order that the series may be related in true proportion to the general program of which it is only the preface, I have been asked to present and explain adequately the Institute plan.

The Institute plan is a structural development program unanimously adopted by the Institute of American Meat Packers in annual meeting, October 10, 1922, on recommendation of the Institute Plan Commission. The Institute itself is the trade and research association of the meat-packing industry of which the products exceed in value those of any other industry in America.

II. THE INSTITUTE

Since the Institute plan represents simply another stage in the development of the Institute itself, some knowledge of how the Institute is organized now, and of what it has accomplished, is prerequisite to a full understanding of its program for the future.

It was in September, 1919, that the American Meat Packers' Association was reorganized as the Institute of American Meat Packers. Accordingly, the Institute is only a little more than three years old.

In that brief period, however, the Institute has made substantial progress toward the constructive purposes for which it was founded. Those purposes, as enumerated in its Constitution and By-Laws, are as follows:

The Institute is organised:

a. to secure co-operation among the meat packers of the United States in lawfully furthering and protecting the interests and general welfare of the industry;

b. to afford a means of co-operation with the federal and state governments in all matters of general concern to the industry;

c. to promote and foster domestic and foreign trade in American meat products;

d. to promote the mutual improvement of its members and the study of the arts and sciences connected with the meat-packing industry;

e. to inform and interest the American public as to the economic worth of the meat-packing industry;

f. to encourage co-operation with live-stock producers and distributors of meat-food products.

It may be said fairly that the Institute has been successful in promoting constructive co-operation among packers. Its membership, embracing more than 250 companies, includes nearly all of the principal meat-packing establishments in the United States.

Those companies which do not conduct slaughtering operations, but which want the fellowship and constructive aid of the Institute, pay annual dues of twenty-five dollars. Each member company which conducts slaughtering operations pays dues measured by volume of production, as follows: one cent for each head of cattle (calves exempted) slaughtered; one-fifth cent for each hog slaughtered.

Thus, while the membership is made up of businesses of all sizes, each pays dues in proportion to its volume of production, and hence in proportion to the amount of benefit it can derive from the trade and research association of the industry.

On the other hand, the voting privilege is not based on the amount of dues paid. Each member company, regardless of its size, has one vote. This tends to insure the functioning of our organization in the interest of the entire membership.

Moreover, by our system of having expert standing committees operate in about a score of different fields—that is, fields covering different branches of the business—every member company enjoys the benefits, on problems affecting the whole industry,

of the very best minds in the entire personnel. No packing-house superintendent is as wise as the collective wisdom of our Committee on Packing-House Practice; no individual traffic manager is as experienced as our Committee on Traffic; no chemist in the industry is as well versed as all the chemists who make up our Committee on Nutrition; no one connected with a packing-house has as much knowledge of live-stock breeding as the combined knowledge of our Committee on Improved Live Stock.

So it is down the line. A member company of the Institute, on any broad problem legitimately affecting the whole industry, has the counsel of the foremost specialists on that subject.

The increasing trend of this sort of co-operative effort by the Institute will be to promote added efficiency or new economics, to the benefit not only of meat packers but also of producers and consumers.

I admit that in the direction of trade information—trade statistics, if you please—the Institute has not rendered the service which many other trade associations give to their members. For example, the Institute does not receive from members and redistribute to them reports of production, shipments, and stocks. It does not report sales.

Such data may have their proper place in trade-association activities, but they are sometimes associated in the public mind with factors influencing

prices—and we have been eager to keep the Institute not only free from blameworthiness, but above suspicion.

I confess, too, that the Institute has not promoted the products of its members as aggressively as some other industries have done.

Do not misunderstand me. The Institute has been tireless in its defense of meat. It has carried its effort for fair play to every quarter whence unfairness came. It has accomplished a great deal toward promoting a better understanding of the food value of meat, toward stopping misrepresentation of that food. For a long time I think it is fair to say that the Institute was the only outstanding champion meat had.

What I do mean is that the Institute never has gone beyond the facts about meat. It has rested the case of meat on its actual merits. It has advocated a balanced diet. It has not maintained that a pound of meat is equal in protein food value to so many pounds of raisins, or so many quarts of milk, or so many packages of breakfast cereal, or so many bars of chocolate, or so many of anything else. It has not sought to advance meat by disparaging or misrepresenting some other food product.

Vendors of various foods have not always followed the policy this organization has adopted. But that has not turned us from our purpose; has not corrupted the progressive spirit of the Institute.

It is well to mention that example here tonight because the associative advertising of many industries surely must have come under the observation of every man who reads and certainly under the observation of our distinguished lecturer who follows with eager interest the production and marketing of foods. I do not believe he will feel the Institute has been remiss for refusing to fight Satan with fire.

It is not only in establishing meat in better position that the Institute has served its membership. The fields in which it renders special service may be indicated best and most briefly by an enumeration of its regular standing committees and of its departments, offices and bureaus.

The regular standing committees of the Institute (their work is indicated by their titles) are as follows:

Executive Committee.

Central Administrative Committee.

Committee on Foreign Relations and Trade.

Committee on Improved Live Stock Breeding.

Committee on Industrial Relations.

Committee on Live Stock Losses.

Committee on Local Deliveries.

Committee on Nutrition.

Committee on Packing-House Practice.

Committee on Public Relations.

Committee on Standardized Accounting.

Committee on Standardized Containers.

Committee to Confer with Government Officials.

Committee to Confer with Live Stock Producers.
Committee to Confer with Retail Dealers and
Trade Associations.

Finance Committee.

Legal Committee.

Membership Committee.

Traffic Committee.

Regional Committee.

The work of the Institute is organized structurally under two departments. One is the Department of Association Management; the other, the Department of Education and Research.

In these two departments are a number of very active bureaus executing a great volume of valuable work. Those bureaus now in existence, or in process of organization, or a consequence of the Institute plan, are:

Bureau of Public Relations.

Bureau of Nutrition.

Bureau of Home Economics.

Bureau of Merchandising.

Bureau of Live-Stock Handling and Product
Delivery.

Bureau of Scientific Research.

Bureau of Packing-House Practice and Research.

Bureau of Industrial Education.

Offices are maintained by the Institute in Chicago, which is the headquarters; in Washington, where the Institute strives to co-operate legitimately with

the Government in such ways as may be requested; and in New York, which is the center of a big consuming center.

When the Institute was organized, the live stock and meat industry was made up of four distinct groups having very little systematic co-operation with one another. Today, the producers, the commission men, the packers, and the retailers have in existence definite machinery for conference and co-operation on common problems. The live stock and meat industry is beginning to function as a unit on matters which are of concern to all factors in it. There is a better understanding by each group of the problems, the difficulties, and the service of the other groups. Each division of the industry is trying, to a degree at least, to help every other division.

In that progress from a state of hostility and recrimination to one of understanding and co-operation, it can be said modestly that the Institute has participated, and that its efforts and accomplishments have been a factor.

The committees and bureaus of the Institute have established better industrial relations, not merely in the narrow sense of personnel relations with management, but in the broader sense of better relations between producers and packers, between packers and retailers.

At the same time, correct facts about the operations and service of the whole industry have been

supplied to the consuming public; to the consuming public as a whole and to special groups thereof.

Similarly, the products of the industry—products derived from the producers' live animals—have been protected from current misrepresentation and old fallacies, and scientific data about them have been compiled and supplied to physicians, dietists, home economists, writers, teachers, and others who influence opinion, as well as to the general public.

Meanwhile, much service work has been carried on within the industry. A study of live stock handling losses has been made and effective propaganda disseminated with a view to decreasing them. Questions on packing-house practice have been answered and articles on good practice wholesaled to the membership so as to reduce costs and improve efficiency.

Extensive research work, including field tests as well as accounting studies, has been conducted on the subject of local deliveries. Some of the results have been published. The major part is still to be published. Economy and efficiency have been urged and promoted, so that producers, packers and consumers may share in the benefits. Cost forms and records on this subject have been evolved and distributed.

Industrial statistics of unquestionable propriety have been supplied to member companies.

Thousands of dollars have been expended carefully to promote better live stock, and articles on this subject have been written and published.

Considerable work on standardization of containers for the purpose of reducing costs has been accomplished.

Successful efforts have been made to improve methods of foreign trading. On one occasion an Institute committee went to Europe on a successful mission to obtain modification of certain trading rules.

Signal services have been rendered by many committees and bureaus which time prevents us from recounting here.

What has been said already probably is sufficient to indicate how the Institute functions and in what directions.

In addition to its own organization, the Institute also participates actively in the National Live Stock and Meat Board, and participates equally with the retailers in the local meat councils and their national association.

These meat councils were organized to promote better merchandising of meat, with consequent economies of public benefit; to promote more cordial relations; and to acquaint the public further with the facts about the meat business. They extend from coast to coast and operate in the following cities: New York, Jersey City, Rochester, Cleveland, Toledo, Detroit, Milwaukee, Chicago, Minneapolis, and San Francisco.

There is not time to tell you what the Institute and the retailers and their associations have accomplished through these meat councils by newspaper

advertising, as at Cleveland, Pittsburgh, Milwaukee, and elsewhere; by demonstrations or lectures in conjunction with colleges, expositions, or other agencies, as at New York, Milwaukee, Chicago, Toledo, and San Francisco; by advising the public how to market, as at New York, Rochester, Chicago, Milwaukee, and elsewhere; by helping to move a surplus of meats into consumption, as in the case of hams in nearly every meat-council city last fall.

Now, instead of detailing these educational and merchandising activities which I barely mentioned, let me give you two examples of the sort of thing accomplished by the kind of co-operation for which the Institute stands and which it has had the privilege sometimes of initiating and sometimes of joining.

The first example:

Producers long have clamored for an improvement in the merchandising of meat at retail. All factors in the trade, including the retailers themselves, have been agreed that more light on merchandising problems and merchandising costs is needed. One of the grave needs has been some average standard of costs, item by item, so that the progressive dealer can compare any item of his cost—say delivery—with his sales; and then, by study of trade averages, see whether his delivery system is costing him more than it should and is needing correction.

This merchandising need was reported to the National Association of Meat Councils by the Insti-

tute. The National Association thereupon reported it to the United States Department of Agriculture and Northwestern University.

Those two agencies, co-operating through the Department's Bureau of Agricultural Economics and the University's Bureau of Business Research, made a theoretical and practical study of accounting in retail meat stores. On the basis of this study they developed systems of model accounts in several different forms adaptable to different types of stores.

The plan was that these systems would be installed as a preliminary to a thoroughgoing merchandising analysis. Returns will be made to the department and the University by dealers using the systems. These returns will be analyzed, reports made to the merchants and norms, or averages, of costs established item by item. Work has been begun.

Another example:

The retailers and packers in the Meat Council of Milwaukee and the famous Central Continuation School, in co-operation, are giving courses in the cutting and merchandising of meat; in the training of a new generation of meat dealers. The National Association is encouraging the local meat councils to set up similar co-operation with vocational training institutions in these other big centers of consumption. Need I point out what a tremendous impetus this should give to good merchandising?

The National Live Stock and Meat Board includes members from the Institute, representing the packing industry; members from the United Master Butchers of America and the National Retail Grocers' Association, representing the retailers; members from the National Live Stock Exchange, representing the commission men; and members from the American National Live Stock Association, the American Farm Bureau Federation, the Texas and Southwestern Cattle Raisers' Association, the Corn Belt Meat Producers' Association, the Kansas Live-Stock Association, and other organizations, representing the live-stock producers.

The Institute has had the privilege of participating in the board from its organization stage to the present. The board stands today on the threshold of its opportunity. It has brought all factors in the meat industry into co-operation on a common purpose, namely: to effect an increase in meat consumption.

Now, let us consider the next advance in the work of the Institute as exemplified in its development plan.

III. THE INSTITUTE PLAN

Before attempting to explain the essential features of the Institute plan, it may be well to make the following chronological statement:

The plan first was submitted to the executive committee of the Institute on February 24, 1922, for consideration. At its April meeting, the executive com-

mittee directed that the plan be transmitted to the entire membership and that the commission and committees provided by the plan be appointed and called into action. On June 1, the plan commission and its committees held a well-attended meeting and immediately thereafter began their work. Subsequently, the committees made their reports to the chairman of the plan commission, and he in turn submitted a consolidated report to the commission.

It was this report which was recommended by the commission and adopted unanimously by the Institute in annual meeting last October.

Briefly summarized, the adoption of this report meant that the Institute adopted the general proposals of the plan as its development program; agreed to raise \$150,000 by voluntary subscription to cover surveys and actual developments during a three-year period, and to modify the structure of the Institute in such a way as to provide for orderly, gradual and specially directed development of the several phases of the plan.

The sum of \$150,000 which was sought has been subscribed. In this subscription there has been a broad participation by the membership. All subscriptions have been entirely voluntary; there has been no assessment.

I doubt whether any industry ever has witnessed a readier or broader response on a co-operative

project. The raising of these funds is eloquent testimony concerning the increased capability and inclination of meat packers to co-operate in the achievement of constructive purposes.

What is more to the point, perhaps, the raising of this money makes possible immediate beginnings looking toward actual development of the plan.

The Institute plan provides for the ultimate development of a structure and organization which shall be a combined trade association, as the Institute now is; an industrial museum, of which the Institute already has developed certain meager beginnings; an industrial research institute, and a technical educational institution.

It is to these last two phases of the Institute plan that I wish to draw your consideration tonight.

Consider first the plan to develop an industrial research institute. It is a new idea as applied to meat packing but an old, well-established idea as applied to other industries. Leave out of consideration the educational side of an industrial institute and consider only the research side.

Perhaps Germany furnishes the most conspicuous examples of such institutes. They are research institutions which serve a whole industry. They solve problems too big for an individual company, discover new methods, conquer old obstacles, and collect and organize valuable industrial information never previously correlated.

To these research institutes, individual companies bring their most difficult technical problems. They clear industrial difficulties and spread good practice, helping to strengthen the entire industry which they serve.

Such institutes have been established in Germany in various industries. It is conceded that no insignificant part of the German Empire's industrial development was due to these research institutes.

The same idea has taken hold and seems to be growing in the United States. Numerous industries now have their central research laboratories, their co-operative testing facilities, in addition to the research organizations and facilities maintained by the individual companies. This tendency among American industries is increasing.

By such a plan it is possible for an industry to undertake research projects which would not repay an individual company but which would repay every company in the industry for its relatively small proportion of the expense when effort is pooled and cost shared.

Then, too, it often is not advisable for a particular company to undertake research which will not yield a reasonably prompt return on the investment. Sometimes it would be necessary to spend a great deal of money on abstract investigations before any effort could be made to apply the results practically. An industrial research institute would endeavor,

perhaps, to keep the abstract scientific information likely to be useful to the industry abreast of necessities.

Finally, there is in the packing industry much duplication of tests of materials and supplies and of other commonplace research. If any part of this duplication can be eliminated, a saving will be effected.

I do not wish to treat the research phase of the Institute plan in too much detail since it is not as directly related to the interest of most of those reading these lectures as is the educational aspect of the development program which the meat-packing industry has adopted. Accordingly, I shall dismiss this division of the subject by quoting from the Institute plan the paragraphs summarizing it. The plan states:

As a research institution, it (the Institute of American Meat Packers) should:

a. Develop and systematize a body of scientific and practical data for the service of the whole industry.

b. Carry on agreed researches into new scientific and practical problems common to all packers, without infringing on research along individual lines being done by specific companies.

c. Conduct experiments on the extension of products and reclamation of materials (except where such experiments would infringe on original work done by some individual company).

d. Collate and disseminate information concerning discoveries and developments having relation to the packing industry, without invading material developed by particular companies.

- e.* Conduct merchandising surveys and commercial research work.
- f.* Discover waste and means of eliminating it.
- g.* Test materials and equipment offered to the industry.

It may be that further consideration by the plan commission's Committee on Scientific Research may modify somewhat the details of that outline. But it indicates in a general way the purposes of the plan with respect to industrial research.

Turn now, if you will, to the educational intentions embodied in the Institute plan. On this subject, the plan sums its purposes by stating:

As an educational institution it (the Institute of American Meat Packers) should do at least three things:

- a.* Provide broad but specialized collegiate education for young men intending to enter the packing industry. . . .
- b.* Furnish special training to intermediate sub-executives (prospective departmental heads) of promise already engaged in the industry.
- c.* Conduct a continuation school for plant employees and junior office help.

It is contemplated, of course, that the advantages of whatever instruction is established at Chicago will be made available to member companies everywhere. This will be accomplished by modern extension methods or a modified shop-and-school system or whatever means, or combination of means, may be found necessary and advisable.

Let us analyze each of the educational provisions of the plan. Consider them in reverse order. First

on this basis is the avowed intention to provide continuation instruction for plant employees and junior office help. By juniors, we mean youngsters.

That is a very large order. It means wholesaling either vocational training or basic education, or both. We all know in a general way how the progress of many beginners, both in plant and office, is hindered by their lack of any sort of training; by their grievous deficiency in common school education. There is soon a big gap, for example, between the office boy who can write a neat hand, spell simple words correctly, and "figure a little," and the boy who can do none of these things.

Similar cases could be cited from the plant. One man, very meagerly prepared for life, makes little progress; another, with a little more preparation, becomes time clerk, bookkeeper, accountant, auditor, treasurer.

We should make it possible for the beginner in plant or office to supplement his fundamental equipment; to make himself capable, by a little more general training or by special vocational instruction, to receive more responsible duties; to do more important work; to develop his abilities fully and express himself through the best work of which he is innately capable.

That is what the Institute plan means in its purpose of providing continuation instruction or training for so-called ordinary plant employees and junior office help.

Just how much the industry, acting through the Institute, can do in this direction, or how far it can interpret, co-ordinate and supplement the efforts of individual companies, is a question I should not care to try to answer at this time. Nor should I like to try to forecast by what methods the maximum can be undertaken most effectively.

Those are questions on which the advice of a specialist is needed. Perhaps we shall find there is little the Institute can do in this regard; perhaps we shall find it can accomplish a great deal. This purpose of the plan, like all others, must be adjusted by what is welcome; what is practicable and what is wise.

In a very general way, this series of lectures initiates preliminary development of that part of the plan previously mentioned which purposes to "furnish special training to intermediate sub-executives (prospective departmental heads) of promise already engaged in the industry."

The term "intermediate sub-executives" is meant to be very broad, including plant foremen, assistant heads of departments, and others. Anyone not covered by that term can consider himself included in the phrase "prospective departmental heads," for the history of the packing industry holds ample evidence of the fact that any meritorious worker in the ranks today is the potential executive of tomorrow. To me, this possibility, this opening to advancement

—with cases studding the record of our business every year, every month, every week, almost every day—is one of the most inspiriting things about the packing industry. There is no inclination to change it.

Our first thought, in developing the Institute plan, was for the men engaged in the industry.

That is the aspect of the plan's provisions which I am trying to present to you now, and, because of my interest in it. I fear that I may have hurried rather brushingly over some of the other features.

At the risk of being personal, let me tell you why I am so much interested in this part of the plan—the part which makes special and primary provision for just the sort of men who constitute the greatest part of this audience. My keen interest springs from the fact that in an adult lifetime, spent entirely within the packing industry, I have learned how hard it is to acquire systematically a knowledge of any branch of the business; how hard it is, after one has acquired a knowledge of one branch of the business, to acquire an adequate understanding of the business as a whole. Incidentally, I might state here that under the present system a worker in the industry learns a certain number of facts or rules-of-thumb without understanding their relation to everything else. Finally, when enough cases of a certain kind of facts come under his observation, he catches glimpses of the underlying principle and finally digs it out. There is no provision for familiarizing him with funda-

mental principles which he may apply to his daily experience.

The present status reminds one of the legal classic of the young law-school graduate whose knowledge was limited to memory of the statutes. He was being examined by a justice of the Appellate Court for admission to the bar. Questions developed the fact that he had not read Blackstone; had not heard of Coke. He did not know the elemental legal precepts governing real property. In fact, common law principles were entirely strange to him.

Finally, the old justice asked:

"Is there anything you do know?"

"Well," responded the graduate proudly, "I know the State code."

The venerable jurist's face registered every symptom of alarm. Leaning over the inquisitional bench, and shaking his finger at the applicant, he thundered:

"Young man, don't you know some fool Legislature is liable to come along and repeal all of your knowledge?"

Sometimes I think our industry has been as short-sighted in its instructional methods, although not in its principles, as the institution from which that young man was graduated.

Meat packing is a highly specialized business in almost every one of its branches. Yet the method of learning any branch of it is the traditional mouth-to-ear system. As a rule, the man below can learn

only so fast as his own experience and the man above can teach him—and generally the man above is too busy to do much teaching except when he fears a mistake will be made or suspects that a mistake has been made. The progress of an ambitious worker is retarded somewhat not only by the failure of the industry to record its knowledge and experience adequately in book form, but also by the lack of facilities for systematic specialized instruction.

Under the casual mouth-to-ear system now in more or less vogue, the worker eager to know more of his task and of the business in which he is engaged has one chief source to which to go for knowledge—and that is to the men about and above him. In a sense, as I have stated before, the man below can learn little more and no more rapidly than the man above can teach him.

Moreover, even if it could be assumed that the head of a department always had the time to supply every yearning of one of his men for information, this would still be a makeshift method. An executive has duties connected with actual operations that have a claim on his time. Furthermore, to interpret and share experience with one employee is a retail deal in a case where a wholesale transaction would be entirely possible and probably no more expensive. It takes almost as much time to tell one man about a certain method as it would take, under a systematic arrangement, to tell fifty men the same thing.

So far, I have had reference particularly—in discussing provision for prospective sub-executives and executives—to specialized instruction.

But in my opinion the plan committees working in this field also should arrange for certain general courses.

The present system of developing departmental executives, in the average case, brings a man gradually from the bottom to the top of the business. There is urgent need, as such men state, of providing facilities through which knowledge of the interrelations of fundamental departments and their functions, as well as the relation of the business as a whole to world economics and social service, can be acquired and constantly broadened.

The fact that many able men began their careers in the industry without broad training for the important duties later to be performed and have been eminently successful is a testimonial to their initiative and adaptability. But how much easier it would have been for each, had the industry provided means whereby his experience could have been broadened by preliminary or concurrent training! There are many of us who would have given a great deal in our earlier careers for an opportunity to supplement systematically whatever knowledge of the packing industry we gained from our daily routine.

Let us resolve now that this opportunity shall be created and used at the first possible moment. We

can help ourselves tremendously and also make the road of progress much smoother, not only for ourselves but also for the generation which comes after us.

In this connection attention should be called, even at the cost of digressing, to the need of systematizing and recording our industrial experience. Subject to limitations designed to prevent infringement on information an individual company might not be willing to share, the experience of the industry should be systematized and recorded. This would be of value in connection with specialized courses and also for reference purposes.

No packing company, so far as I know, has any adequate system for perpetuating and handing down to the next generation in readily available form the sum of its experience. If this experience could be reduced to systematic book form, certain knowledge now requiring twenty years to gain might be gained in one. It would be interesting, for example, to take a census of the books in any packing company's library on packing-house practice. I imagine they would not fill many rooms. Yet the packing industry is the largest industry in the United States and should have a tremendous practical bibliography, as is the case with any other technical industry.

Return now, if you please, to the formal instructional aims of the Institute plan.

I have now discussed two features of the plan's educational purposes. One was special training or

continuation instruction for plant employees and junior office help. The second, which is highly important, was specialized instruction and general courses for prospective executives and sub-executives who already are engaged in the industry. The third, on which a start has not yet been made, is collegiate instruction for young men intending to enter the meat-packing industry.

Do not misunderstand me. The members of the Institute have no intention of turning over their businesses to young graduates on whose diplomas the ink is still moist. They do not concede, nor will educators maintain, that a collegiate institution, no matter how highly specialized, can graduate young veterans of twenty-one who will be qualified forthwith to run a packing-house. The thought, on the contrary, is this:

We are now receiving a number of college-made beginners every year. But there is need of an institution which will give them our special "cure." We do not want to alter the human material; we do not want to change the rations very greatly; we should just like to smoke the product a little heavier on the packing-house side.

Seriously, gentlemen, just as there is no adequate provision for giving a broader outlook to men of promise already engaged in the packing industry, who may wish to supplement their training, so, too, there is no adequate way by which the industry can draw

to itself well-trained beginners or specially trained scientists. Like other industries, the packing industry attracts a number of college-educated men. But unlike other industries, the packing industry has no way of drawing to it college-trained men whose training fits them especially for this industry. The steel industry, the textile industry, the mining industry, and others draw men whose college educations have been designed to make them especially serviceable to these industries. Not so with meat packing. The college man who comes to meat packing would feel as much at home in any of a half-dozen other industries.

Just how instruction for young men intending to enter the industry should be arranged; what subjects should be taught in addition to a general curriculum; how far specialization should go; whether some modified form of the so-called shop-and-school system should be employed; whether instruction should be offered under the independent auspices of the Institute, through some existing institution, or by the two in co-operation—all of these are questions that cannot be answered until a thorough survey of the educational problems and possibilities of the industry can be made by a specialist and the counsel of educators of different specialization obtained.

I now have presented briefly the essential parts of the Institute plan and have discussed very generally two of its four features. By way of recapitulation, I should like to recall that the Institute plan provides

for the eventual development of an organization which shall be a trade association, as the Institute is at present; an industrial museum, which was proposed in the plan as an item having merit of its own, but also as a convenient means of financing an appropriate building; a research institute; and an educational institution providing instruction for persons already engaged in the packing industry and for persons intending to enter it.

Arrangements have been made to assure the orderly, conservative and sound development and financing of this plan. Reference to the first few pages of the program of these lectures will show the personnel of the plan commission and its committees.

In line with the purposes of the plan, additional bureaus—a Bureau of Scientific Research, a Bureau of Industrial Education and a Bureau of Packing-House Practice and Research—have been created within the structure of the Institute. Specialists to direct these bureaus will be engaged shortly.

Meanwhile, the series of lectures which we are beginning now constitutes the initial educational activity conducted under the plan.

IV. SURVEY OF LECTURE SERIES

It is not pretended that these lectures are specialized. They do not constitute a "course." One of their confessed purposes is to awaken added interest in the Institute plan.

Yet they have another purpose: to give a generalized survey of the American meat-packing industry, its background, its service and its operations. To the man engaged in the industry, the lectures do even more than that; they furnish to him a sound and comprehensive point of view toward the business in which he is engaged; they enable him to see it as a whole.

To the student, these lectures will have additional value. They will make a contribution to the literature of the packing industry. Nowhere is a continuous and authoritative presentation of the subjects covered in the lectures now available. In that sense, they break new ground.

Besides trying to explain the essential features of the Institute plan and to relate the lecture series to it, the lecturers collectively will furnish a sweeping view of the meat-packing industry.

This series will present the fundamental facts concerning live-stock production—a prerequisite to meat packing. It will lead you interestingly into agricultural economics and indicate the interdependence of stockman and packer. The commercial geography of the nation's meat supply in the form of animate raw materials will be pictured vividly. This whole subject of live stock as the basic raw material of meat packing will be presented to you with the weight of authority by Mr. Henry C. Wallace, the distinguished secretary of the United States Department of Agriculture.

Then Mr. L. D. H. Weld, an economist of high standing, will tell you of the historical and economic foundation of the business in which most of you present here this evening are engaged. His lecture will trace vividly the progress of our industry from its former status as an aggregation of cross-roads slaughterhouses to its present estate as single industry in the United States, perhaps in the world. He also will tell you, precisely and interestingly, of the service which this industry is rendering to-day; will show you by facts, not by assertions, the distinctions of meat packing in relation to other businesses and its economic functions by which, in fulfilling them, it is serving the nation, serving the world and serving them well.

After you have heard an authoritative discussion of live-stock production, the packer's raw material, and an authoritative presentation of the packing industry's history and economic functions, you will hear an interpretative description of the packing-house and its equipment by Mr. Arthur Cushman, general superintendent of a packing company with numerous plants, and consequently, varied operating problems.

From this lecture one will learn how the physical equipment is adapted to special industrial needs. He will learn, too, of the stages by which the modern packing plant has become what it is; and, in addition, he will learn how the plant operations are organized, and the personnel directed.

Of course a packing plant, evolved in close conformity to the history and functions of the industry and in relation to the raw material it is expected to convert, is a fine industrial structure. But unless its wheels can turn it becomes an industrial monument; and for that turning, money is needed.

There must be capital to buy the live stock, to fulfil the plant's economic purpose, to operate, to pay the men. Financing the industry is no small and simple task. Mr. E. A. Cudahy, Jr., vice-president of a large packing company, will explain the magnitude and complications of packing-house financing. He will discuss the tremendous purchases of live stock for which the industry must provide cash; the huge volume of business at home and abroad, which must be financed; the frequency with which capital must be turned; the narrow rate of profit on which sales must be made, interest met and dividends paid. He will tell you of the different forms in which packers borrow and lend, buy and sell.

Then the modern plant, standing as a symbol of the evolution of the industry, having purchased its live stock and arranged its finances, can begin operations.

One big branch of its operations is that generally classified as cattle operations—the production of beef and by-products. This subject, with lamb operations included, will be handled by Mr. V. H. Munnecke, manager of the Dressed Beef Department of a very

large packing company. It is enough for me to say that the operations of which Mr. Munnecke will tell you constitute a daily romance of business; fascinating transactions on a market influenced appreciably by factors as diverse as drouth in Texas, harvest in Kansas, rain in England or a religious holiday in New York.

What might be called a companion lecture will be delivered by Mr. Oscar G. Mayer, general manager and vice-president of a well-known packing company. He will explain the operations on pork and its products, thus covering the other main classification of packing-house production.

In processing the beef, the lamb, the pork, and particularly the by-products, various sciences are utilized. By the aid of chemistry, physics, bacteriology, and other sciences, economies have been effected that were unimagined a few decades ago; valuable products have been derived from materials once wasted. Mr. W. D. Richardson, chief chemist of a packing company whose name is known to all of you, will show you the rôle science has played in the development of the packing industry, from the status wherein the by-products were dumped through a hole in the slaughterhouse floor to the hogs beneath, to its present stage where the laboratory gives a trend to growth.

When, with the aid of science, the products have been made, there still is the big problem of distribu-

tion. This includes seasonal cold storage of surplus production, so that it may be withdrawn in later time of scarcity; the shipment of perishable foods hundreds of miles, the sending of a wagon-load of meats across town, and a steamer-load of meats across the ocean; wholesale marketing; branch-house merchandising; local deliveries, and other distributive processes.

This broad subject will be presented to you in an authoritative way by a gentleman known throughout the packing industry, the president of one of the largest packing companies in the world, Mr. F. Edson White.



Inaugural Lecture

LIVE STOCK: THE BASIC RAW MATERIAL
OF THE PACKING INDUSTRY

BY

HENRY C. WALLACE



LIVE STOCK: THE BASIC RAW MATERIAL OF THE PACKING INDUSTRY

The work of the Institute of American Meat Packers, since it was organized in 1919, has been noted with sympathetic interest by those in positions of responsibility with relation to the live-stock industry. I suppose it is fair to assume that the primary purpose in the organization of the Institute was to promote the interests of its members and of the packing industry in general, but from the beginning, so far as I am able to judge, its affairs have been directed in a spirit which recognizes as well the interests of the producers who furnish the raw material and of the handlers and consumers of the finished product. The results so far ought to be gratifying to those of you who have had an active part in the conduct of the Institute. Certainly there has been a vast improvement in the relations between you and the people from whom you buy and those to whom you sell, and it is a matter of common knowledge that the packing industry now occupies a more desirable position in the eyes of the general public than at any previous time in its history. All of this is helpful, not alone to you, but to the live-stock producers and to the distributors and consumers of meat and meat products.

Now you are taking the first step toward the realization of your plan to enlarge your ability to serve yourselves and to serve the producers and the consumers, by providing the means for securing a trained personnel, by organized scientific research, the results of which shall be made available to the entire industry, and by the continued cultivation of a better understanding between yourselves and the people whom you serve. In this effort you can surely expect the good will of the other factors in the great live-stock and meat industry.

The development of the packing industry during the lifetime of most of the men who are now active in it has been one of the greatest of our industrial achievements. The census of 1919 shows that the value of the meats sold by the wholesale packing industry was almost 7 per cent of the total value of all manufactured products, amounting in that year to the enormous sum of \$4,250,000,000, and it is worthy of remark that this sum was only $12\frac{1}{2}$ per cent greater than the amount which the packers paid for the live stock. Notwithstanding the already wonderful development of this industry and the apparent efficiency with which it is now conducted, it is certain that the results of organized scientific research in the fields of manufacture and distribution, applied by a well-trained personnel, will enable you to reduce still farther the margin between the cost of the raw material and the re-

turns for the finished product, and with profit to yourselves.

The producers of the raw material and the handlers and consumers of the finished product will, of course, share with you the fruits of your efforts. Each group which has a part in the conduct of the live-stock and meat industry has a direct interest in the efficiency with which all other groups function. It is one great industry, including all operations, from the production of the live stock on the farm to the distribution of the meat to the consumer. It can prosper most only when each party to it not only performs his functions efficiently but when all work together and with full recognition of their respective duties and responsibilities. It may be taken for granted, therefore, that in this new enterprise which you are now undertaking you will have the good will of both producers and consumers.

You have asked me to speak on the subject of "Live Stock as the Basic Raw Material of the Packing Industry." I cannot speak with much knowledge of the packing business, but I can well understand that if it is to be carried on in the most efficient way there are certain requirements with regard to raw material.

First, the supply of live stock should be large enough to permit profitable utilization of the packing plant and equipment.

Second, this supply, while necessarily varying with seasonal demand, should be distributed through

the working days as evenly as possible, thus equalizing labor needs.

Third, the character of the live stock, in size, quality, and degree of finish, should be such as to meet the needs and desires of the consuming public.

Now, anyone who has even a superficial knowledge of the business knows that none of these requirements is being fully met at the present time. The volume of the live stock which the packers are required to handle year by year (and I say required advisedly, for with the growth of the business the packers have accepted the responsibility of taking at some price everything that may be sent to them, without regard to anything other than it reach the market, alive or dead) varies greatly one year with another. The receipts of live stock are not evenly distributed during the working days. The character of the live stock, while showing a reasonably steady improvement, still leaves much to be desired. I propose to discuss briefly these three principal major requirements in the matter of raw material.

THE SUPPLY OF LIVE STOCK

Live stock, this basic raw material of the packing industry, is the greatest single finished product of American farms. The packing industry takes up its job at the point where the farmer has already completed a conversion of crops into animals. It is from this fundamental angle that the grower looks

out upon the meat industry. Having loaded his stock aboard train, matters thereupon largely pass out of his hands. From that point on, the responsibility for getting the meat to the consumer rests with others. The packer buys this stock as raw material and pays the going price. It must be remembered, however, that for the grower this is the sale of finished product, into which he has already put his labor and raw materials.

As the packing industry has grown into a highly organized, specialized machinery, so live-stock production has changed with the development of the country.

A couple of generations ago sheep and beef cattle were the products, in large sense, of a frontier agriculture. That is the usual history in a new country. With free land, unlimited range, and meager transportation facilities, sheep and beef cattle were the logical thing. They not only harvested the grass but carried it in most cases a good part of the distance to market on their own four legs. As land came under the plow, no small part of the early grains and roughage were still fed and marketed in the same fashion. Seventy-five years ago the eastern highways were dotted all summer with droves and flocks being driven from Ohio to New York, Philadelphia, and the coast cities.

The animals that moved over the road in those days met all the ups and downs of capricious markets.

But they were cheaply produced; they represented the product of a pioneer agriculture which, in terms of dollars, had little to lose and much to gain. In similar fashion, the vast country west of the Mississippi early sent back a large part of its products on the hoof.

But those times are gone. Land has grown more valuable. The country has divided itself up into regions of more or less specialized production. A great urban population has grown up, which must be fed every day in the year, and which lives, furthermore, a thousand miles or more from the regions of surplus food production. America today cannot depend on any frontier agriculture for its meat supply. It cannot even depend on beef cattle and sheep alone, but has called forth vastly more intensive animal industries in the shape of swine, dairy cattle, and poultry.

Now we have increasing specialization within the live-stock industry itself. Some regions produce sheep, but others finish the lambs for market. Some regions grow the steer; others put the fat on his ribs. Hogs are grown in large numbers in regions best adapted to corn, our greatest grain crop.

It is no longer merely coarse, by-product roughage that goes into the making of meat, but the finest quality grain as well. Cost of production has become something more than a figure of speech with the men who make and ship you your raw material. The pro-

duction of live stock for market has become in a sense a manufacturing enterprise. The farmer, with an average capital investment of \$20,000 to \$40,000, with heavy labor costs and expenses of all kinds, cannot send his finished lambs, steers, or hogs to market with quite the stoicism of the frontiersman. He not only has something to gain, but he has a great deal to lose.

This situation is the natural outgrowth of changed conditions. It must be recognized as a fundamental consideration. We can never go back to the free-land, exploitive days in this country for raw materials of any kind.

The ideal condition would be one in which the consumption of meat and meat products year by year would be kept at a point which would insure the consumers eating that amount of meat which is most conducive to adequate nourishment and the highest degree of health, and varying only with variations in population. Such a condition would make it possible for the producers of live stock more nearly to adjust their production to the needs of the consumer, maintaining a supply which would be fully adequate to meet those needs. Under such conditions many of the difficulties of the packing industry would vanish and it would be possible to maintain packing operations more nearly on the basis of a stable manufacturing enterprise. This would remove many of the risks incident to the packing business and ought to

result in a material reduction in the cost of operation and therefore a narrowing of the margin between the price paid for the live stock and the price at which the meats are sold.

Unfortunately, we are far from having attained such an ideal condition, and the supply of live stock varies greatly, even year by year. This variation in the supply is influenced mainly by the price paid for the live stock, and in turn the price paid is governed largely by economic conditions which influence the amount of meat consumed and by climatic changes which influence the production of crops upon which live stock is fed and thus raise or lower the cost of production. Live-stock producers naturally wish to make a profit. Unless they do make a profit on an average, year by year, they are forced out of business. When prices of live stock are high, production is increased; when prices are low, production is decreased; and in a general way the volume of production goes up and down with prices. So we have periods of feast and famine which add greatly to the risks, both of live-stock production and of the packing industry.

Few people who have not studied the matter realize the great variations in live-stock production and live-stock slaughter. It must be admitted at the outset that statistics of production are not as accurate as we would like to have them. To secure and maintain thoroughly dependable production sta-

tistics would require expenditures to an extent which the government has not as yet felt justified in making. Production statistics, therefore, are still largely in the nature of estimates, but these estimates are becoming more accurate, year by year. We have, however, an actual count of the number of animals killed in packing-houses which send meat into the interstate trade; and this count serves as a check upon the estimates of production.

It is interesting to note production estimates and inspected slaughter reports in recent years. In 1910 the number of cattle and calves *other than dairy cattle* on farms in the United States was estimated to be 37,926,000 head. Three years later the estimate was 36,030,000. In 1919, six years later, the estimate had increased to 45,085,000, a net increase of 25.1 per cent. In 1922, the number had dropped to 41,324,000, a decrease of 8.3 per cent in three years. The yearly slaughter of cattle under federal inspection from 1914 to 1918 varied from 6,756,737 to 11,828,549, an extreme variation in a period of five years of 75.1 per cent. In 1921 the number slaughtered had decreased to 7,608,280 head, or 35.7 per cent. The number of federally inspected calves slaughtered in 1914 was 1,696,962 head, while in 1922 the number was 4,181,569 head, an increase during this eight-year period of 146.4 per cent. The integrity of statistics as to beef cattle is somewhat impaired by the fact that we have, as yet, no accurate

measure of the number of dairy animals that enter into consumption.

Naturally in the case of hogs, the production of which necessarily covers a period of only one year and which therefore responds more quickly to price conditions, there is an even greater yearly variation. In 1910 the number of hogs was estimated to be 54,037,000; in 1914, 58,933,000; in 1918, 70,978,000; in 1919, 74,584,000; whereas two years later, or in 1921, it was estimated to be 56,097,000. The increase in 1919 over 1918 was 5.1 per cent, but during the next two years the number decreased 24.8 per cent. In 1914 the number of hogs slaughtered under federal inspection was 32,531,840. In 1916 the number had increased to 43,088,708 or 32.4 per cent in the two-year period. In 1918 the federal inspected slaughter of hogs was 41,214,250; in 1919, 41,811,830; while in 1921 the number was 38,982,356; a decrease between 1919 and 1921 of 6.8 per cent.

In 1911 there were approximately 53,633,000 head of sheep in the country. From that year there was an almost continual decrease until in 1922 the number was estimated to be only 36,048,000, a decrease in the eleven years of 32.8 per cent. The number of sheep and lambs slaughtered under federal inspection in 1914 was 14,229,343. In 1917 this number had dropped to 9,300,000 a decrease of 34.5 per cent. In 1921 the number slaughtered was 13,000,000.

The production figures, as stated, are estimates, the best that can be made with the money and machinery available. The slaughter figures, however, are exact, but include only inspected slaughter, and these show such a variation in the annual supply which the packers must handle that the difficulties of conducting the packing business and the risks incident to it at once become apparent.

It is perfectly evident that the supply of raw material in the form of live stock can never be adjusted with the nicety in which the raw material in most other manufacturing enterprises is adjusted, desirable as this would be for all concerned. Live stock is produced on some 6,000,000 farms in the United States, in addition to the great range areas of the West. Even if the exact amount of live stock needed by consumers year by year could be accurately determined it would not be possible to produce just that amount, because of the difficulty in controlling production on these widely scattered farms and ranges. The best that can be done is to strengthen our statistics as to production and disseminate them more widely, and also our statistics as to conditions which influence consumption, both at home and abroad.

The question of financial credits has an important bearing on both production and marketing. Stock-raising and feeding are, in certain sections of the country, highly intensified as to season and operations.

In portions of the range country, and in fact the corn belt, stockmen have had difficulty to adequately finance themselves in times gone by. A system of credit better adapted to the needs of live-stock producers should tend to encourage a more uniform production and a more even marketing. Short-term credits expose the borrower to the danger of being called upon to pay in times of financial stress and compel him to send immature live stock to market. The effect is to depress prices and flood the market. Terms of credit adjusted to the normal turnover periods of live-stock production should result in a more stable supply of live stock and more regular marketing. The prospects of a better system of credit seem favorable at the present time.

MARKETING LIVE STOCK

In considering the matter of marketing live stock, two things are to be kept in mind. First, the marketing period, especially for live stock, the meat of which must go into early consumption, should correspond, so far as possible, to the season when there is the greatest consumptive demand. Second, the marketing should be distributed through the weeks and months in such a way as to make possible the most efficient operation of the packing plants.

In the earlier years of our development the marketing of live stock was almost wholly seasonal, following the crop-growing season. In a broad way, the

marketing is still related to the crop-production season, on the one hand, and the heavy meat-consuming season, on the other. But with the development of the processes of packing, the building up of the great central markets, the improvement in our great transportation systems, as well as in our crop and live-stock marketing processes, the marketing is now much more evenly distributed through the year. In all large groups of producers there is a small percentage of the more intelligent who search for the most profitable outlet for their products and try to have them on the market during the period of the best prices. There are many such engaged in the production of live stock for market. They study seasonal requirements, as well as seasonal marketing, and endeavor to send in their own stock either ahead or behind the heavy run of that particular class of stock, and profit accordingly.

Good salesmanship not only endeavors to meet the demand of the consuming public, but undertakes, to some extent at least, to so influence that demand as to increase it for the particular commodity which the salesman has to sell. It is reasonable to suppose that material changes can be brought about in the demand for meat products of various kinds if systematic effort should be made. It will not be surprising if, as a result of the research studies you gentlemen now propose to undertake, you may bring about profound changes in the desire of the consumers,

both as to the kinds of meats and as to the time they may be taken. This is very properly a part of the effort to standardize and perfect your business and thus make it more profitable, and naturally is a matter in which live-stock producers have a very direct and vital interest.

The matter of equalizing market receipts is almost as old as the establishment of centralized markets and still awaits a satisfactory solution. In times past very likely many buyers considered violent fluctuations in market receipts as entirely to their advantage in buying. Such fluctuations are to the advantage of the speculator who may be in business one year and out the next, but to the permanent disadvantage of the man who desires to build up a profitable, continuing manufacturing enterprise, because violent price fluctuations pave the way to discord and disorganization of the live-stock industry. Certainly the men who direct the great packing enterprise of the present day realize that the more nearly prices for live stock are kept upon a stable and profitable basis, the greater their own gain, in the long run. Receipts of hogs up to 60,000 or 70,000 on one day, resulting in a glutted market and a severe cut in prices, and only 20,000 perhaps on the following day, bring about a condition which is hurtful to the entire industry. And so with cattle and sheep. These distressing gluts and shortages, with corresponding fluctuations in price, have contributed not a little to

the dissatisfied state of mind of producers in times past. The great bulk of producers market stock only once or twice a year. If they happen to go to market on a day on which there is an oversupply, and a corresponding decline in price, they may find the profit of an entire year's effort wiped out. Under such circumstances there is no consolation in the thought that had they reached the market the day before or the day after the result would have been a substantial profit. Nor do they find any greater satisfaction in the fact that the average prices for that particular week were on the whole satisfactory.

It is quite true that the packer has not the power to direct or control this flow of stock to market. Moreover, he naturally feels that he is entitled to some credit for being willing to buy at some price whatever comes to market and all that comes to market. Market flow is primarily the problem of the producer, but in solving it he must have the help not alone of the packer, but of the transportation system and of all of the agencies which are charged with responsibility to the live-stock and meat industry.

It is worth noting that in recent years apparently there has been a distinct tendency toward stabilizing the flow. If we go back, for example, to the five-year period, 1911-15, and compare the flow with the year 1922, we get some interesting results. For example, expressed in percentage of the total weeks' receipts,

supplies of cattle at Chicago, on an average for the five-year period, were distributed through the days of the week as follows: 43 per cent on Monday; 9.8 per cent on Tuesday; 33 per cent on Wednesday; 9.9 per cent on Thursday; 3.5 per cent on Friday, and .7 per cent on Saturday. During 1922 the Monday run had dropped from nearly 43 per cent of the week's total to 35 per cent. The Tuesday's run had nearly doubled, increasing from 9.8 per cent to 18.2 per cent. Wednesday's receipts, instead of being 33 per cent of the total, as in the five-year period mentioned, amounted to but 18.8 per cent. Thursday's run was 18.4 per cent compared with 9.9 per cent; and Friday brought 7.5 per cent of the week's total receipts, compared with 3.5 per cent in pre-war days. There was a similar better equalization of receipts of calves, hogs, and sheep over the pre-war period. It is not wholly safe to base conclusions upon a comparison of one year with a five-year average, but the figures I have quoted evidently show that some progress really has been made toward a better distribution of receipts through the days of the week.

In very recent years the growth of producers' co-operative marketing associations raises the question whether the time may come when the flow of live stock to market may largely be influenced by such associations. Probably very little such influence is being exerted at the present time, and it is doubtful

whether the time will ever come when the marketing of live stock can be directed so largely by strongly centralized co-operative associations as in the case of cotton, tobacco, and some other crops. Live stock cannot be held when ready for market. It is not susceptible of being cribbed or sacked or warehoused. It is quite conceivable, however, that thoroughly well-organized co-operative live-stock associations, which will be kept fully informed of the amount of stock being fed by their members and the approximate time when it will be ready to market, can so influence the flow as to greatly stabilize the receipts at the principal markets.

IMPROVEMENT OF LIVE STOCK

The development of the country and the consequent specialization in the production of live stock have brought about almost unbelievable changes in the form, size, and quality of our live stock and its adaptation to the demands of the market. This improvement is the direct result of the application of the highest forms of art and science. The breeder of improved live stock is an artist just as truly as those who produce beautiful paintings or sculpture to satisfy the eye. He is a scientist as well, because the success of his efforts depends upon an understanding and application of the laws of heredity and the laws of nutrition. The product of his art and science is as essentially a part of our national life and well-

being as that of the greatest engineer or the most talented craftsman. He has reduced to the minimum those parts of the animal which are the least useful, and increased those parts best adapted to human needs. He has greatly shortened the period of growth, hastened the period of maturity for market, increased the power of the animal to assimilate and convert into the meat the foods available, and has given it those physical characteristics most needed to thrive under our varied conditions of soils and climate. Only those who can visualize the raw-boned, long-legged steer of fifty years ago, the slab-sided, long-snouted hog, can fully appreciate the debt we owe to the art and science of the breeder and feeder.

And their work is not yet done, and probably never will be, for we have not by any means attained the pinnacle of success in the most economical production of live stock, and there must be almost constant change in form, size, and quality to meet the changing tastes and demands of the great consuming public, both at home and abroad.

As our population increases and the pressure for food becomes more urgent, the lavish feeding of grain to live stock will decrease, because of the increase in the value of the grain, and we shall be put to it to produce an equally high quality of live stock through the greater use of foodstuffs not so well adapted to human consumption.

THE DEPARTMENT OF AGRICULTURE AND THE
LIVE-STOCK INDUSTRY

The federal Department of Agriculture is charged with large responsibilities in relation to the live-stock and packing industry. Upon it we must depend largely for our knowledge of the supply of live stock in the country; of its movement to market; of conditions, national and international, which are likely to influence demand. It is charged with the task of safeguarding the health of the live stock; of inspecting meats; of correcting unfair practices, if any such are found to exist at the great markets; and with a host of other duties in connection with the industry as a whole. It carries on scientific research in fields which can best be entered by the use of the large resources and facilities of the federal government; co-operates with the various scientific agricultural institutions in the states in work which can best be done there; is responsible for the general direction of the extension work through which the results of scientific work are carried to the farms, both by printed matter and by word of mouth.

The department has under way a definite campaign for the improvement of the quality of live stock. Cow-testing associations have given the farmer a chance to detect and eliminate the low-producing females. The development of a large number of bull associations has resulted in reversing the ratio of grades to purebreds and in some areas has already

resulted in banishing the scrub. Little is as yet known with reference to the inheritance of characters in the larger animals. Experiments in this field involve long periods of time, the investments of large sums of money, and the maintenance of a highly trained personnel, a combination which has deterred most of the state institutions from attacking these problems. The Department of Agriculture is planning to enlarge its work in this field and to invite co-operation with the states interested, looking to the development of a single national plan of research into the fundamentals of live-stock improvement.

The department has a most honorable record in its battle against animal disease. It won a complete victory over contagious pleuro-pneumonia in 1892; and has fought six successful battles against foot-and-mouth disease, which seems to be permanently established in Europe, Asia, and much of South America. It has mastered Texas fever, has driven it out of 643 counties, and within a comparatively few years probably will have eradicated it entirely. It has developed effective means of combating scab and worms in sheep and cholera and certain forms of destructive parasites in hogs. Its scientists are constantly at work studying the life-history of every known variety of animal parasite and developing means of destroying them without injury to the infested animals. It is leading the battle against tuberculosis, which causes such enormous losses in

both animal and human life; and in general furnishes the leadership in the warfare against animal disease.

To speak even in general terms of the varied activities of the department in connection with the live-stock and packing industry would require far more time than could be allotted to one evening's discussion. There are one or two phases of our work, however, which are especially worthy of consideration on an occasion of this sort. I refer particularly to our market information work and to the enlarged efforts we are making to gather and make known statistics as to live-stock production.

The federal market news service on live stock and meats began in 1916 when information on the monthly supplies of meats in cold storage were collected and published. Monthly reports on the receipts and distribution of live stock at public stockyards followed soon after, then the daily market reports on the supply, demand, and prices of meats by class and grade to the eastern consuming centers were undertaken. When the nation plunged into the world-war and need of market information as a means of preparedness was critical the market service on live stock was extended to all primary markets of the country as a war service. Daily reports on the supply, demand, market conditions, and prices of live stock by class and grade were undertaken in 1918 in the leading live-stock markets by trained market reporters of the department.

No market reporting service on live stock or other farm products is of much value unless it is made on grades. It was found that grade standards and grade names varied at practically every market. There was no universal standard of market classes and grades. With the assistance of producers, universities, packer representatives, commission men, and other agencies interested in the marketing of live stock, grade standards were adopted for reporting purposes. These standards have been corrected, refined, and made uniform for the whole country, and are used wherever the agents of the Department of Agriculture report the market. Now a Number 1 or choice steer on the Chicago market should be a Number 1 or choice steer on any other market where the department is represented in this capacity.

A leased wire from Boston on the east through the large meat-consuming centers and the large live-stock markets of the Middle West, to Omaha on the west, St. Paul on the north, and Fort Worth in the south carries this information hourly from six o'clock in the morning to six o'clock in the evening. After July, this year, the leased-wire service will extend from coast to coast and into the southeastern states. At all points along the line the information is given out promptly to all interested parties by messenger, telephone, telegraph, and mimeographed reports going to farmers and the trade. The information is given to the Associated Press, United Press, Western Union and Postal Telegraph, and other market-news

disseminating agencies. These in turn give it to their subscribers, including producers' organizations, packing companies, elevators, daily and weekly papers, live-stock exchanges, state organizations, and others. Nearly all of them spread the information farther and indefinitely with the result that the information is available from coast to coast and from the Gulf to the Canadian border within a brief period after the facts are recorded. It is found in the columns of practically every financial journal, prominent metropolitan and local daily and weekly paper, and trade and farm magazine. Those having access to the information acquired through this service number many millions, with the result that the American stockman can, if he chooses, be the best-informed farmer in the world regarding markets for live stock.

The radio, which is in its infancy, is proving a most valuable agency. Forty-seven powerful stations throughout the country are today broadcasting the live-stock market information to distant farms and ranches, many of which are rarely visited by the postman or have access to the telephone or telegraph. By this means, the farmers and stockmen can be, and some of them are, as well informed as the man on the market, and no doubt the number will increase rapidly.

Other information giving the forecasts of the probable production and of the live-stock conditions, supply, and changes on farms and in feedlots which is being developed and perfected by the department

will also reach the farmer and stockman promptly through these avenues of dissemination. Thus the man who produces the basic raw material of the packing industry and the meat for the domestic and foreign table will be able to shape his program so that there will be a maximum of efficiency and minimum of lost motion, waste, and loss. The same benefits also are at the same time provided for all other agencies whose activities are articulated with those of the stockman.

The live-stock movement and supply work which was started during the war has again been revived on a more comprehensive, reliable, and practical scale, and a very definite program for estimating farm holdings, marketable surplus, and probable movement of live stock is being developed, which should assist very materially in the stabilization of the industry, in that it will make available to everyone interested dependable information concerning the changes which are taking place on farms, the available marketable supply, and the probable amount and time of movement. This work for the present is being confined largely to the corn belt and western states. The program in brief includes the following lines of work:

1. A semi-annual survey of the pig situation, with a view to estimating the size of the spring and fall crops of pigs and the number of pigs of various ages on farms. These surveys are being made by the rural mail carriers of the Post-Office Department, under the direction of this department. As this

work develops it will no doubt tend to prevent the great fluctuations which have occurred in the past in the supply of hogs for market, which has resulted from a lack of knowledge of the real situation.

2. Monthly estimates during the feeding season of the number of cattle and sheep on feed in the principal feeding areas, with information as to the character of the stock on feed and probable time of marketing. This work was commenced in December of last year and will be carried on throughout the feeding season.

An organization is being set up for the estimating of the calf and lamb crops of the range states, and also for the making of estimates of the available supply of feeder stock in various areas for both cattle and lambs.

Estimates will be made this spring of the probable movement of lambs from California, Kentucky, Tennessee, and Virginia, which it is hoped will result in better distribution of the marketing of these lambs throughout the spring season.

As the organization is perfected and more reliable data are assembled, this service should become one of the most useful and constructive provisions that has ever been made for any industry, and especially for the stockmen and packers.

The department is now making a broad study of the various methods, practices, and costs of marketing live stock. The results should show the relative efficiency of the various methods that are now followed

and should enable the stockman to select the method most favorable to his circumstances.

The lamb markets of the country have been subject yearly to violent and apparently unnecessary fluctuations in prices due to the alleged oversupply at the Jersey City and New York markets between June 15 and August 15. The department has investigated this and found the trouble as indicated. It was also found that it was not due to oversupply of lambs, but an oversupply of inferior lambs. Co-operative efforts on the part of the Department of Agriculture, representatives of stockyards and meat packers at Jersey City and New York, and producers' organizations, extension forces, and state marketing officials in the states concerned promise to eliminate this condition. In fact, much material progress has already been made.

COST OF PRODUCTION STUDIES

In the belief that knowledge of the cost of production is essential to the successful conduct of any business, the department is systematically inquiring into it. In these studies we are attempting to go farther than merely tracing the relative economic position of the live-stock producer in respect to workers in other productive industries; we are bending every effort to serve through these cost data the farmer who produces meat; assisting him to better organize his farm and plant for more economical meat production, to feed those rations which as prices change prove to be the most economical,

and to handle breeding herd and range so that best results may be secured; in brief, to so fit live stock to his crop production that a permanent system of agriculture may be developed. In this work, the department is in continual personal contact with hundreds of live-stock producers from New York to California. It works with the ranchman of Colorado and Texas, the grass man of the Flint Hills of Kansas, and the corn-belt farmers in many corn-feeding sections, making careful study of the economical methods and practices for converting the corn and roughage of these corn-belt farms into beef, pork, and mutton. Today thousands of live-stock producers, ranchmen, feeders, and small drove and flock producers are working with the department the year round in developing efficient and economical systems of production that will continue to function.

In conclusion, permit me to emphasize a thought I have already suggested, namely, that the live-stock and meat industry is one great industry, the success of which depends upon the efficient functioning of several different groups; first, the producer of the live stock, then the transportation company, the stockyards and stockyards agencies, the packers, the wholesalers, the retail meat dealers, and finally the consumer, whose duty it is to eat with discrimination and as freely as his purse will permit and his bodily needs require. To these groups must be added those federal and state agencies which are charged with responsibilities with relation to the

industry. If any one of these groups fails to function efficiently the entire industry is hurt. There is, therefore, a mutual interest and interdependence which should make for full co-operation and harmonious understanding. Suspicion, greed, unfair practices, or any act on the part of any of these agencies or groups that will put any other at a disadvantage is an offense against all. It is a satisfaction to record that at the present time there seems to be more complete co-operation than at any time in the past, and I venture to express the hope that this spirit of co-operation will grow rather than diminish.

In speaking of the various groups which have a direct interest in this great industry, we must ever keep in mind those unborn generations which will follow us and for whom we of the present time hold in trust the soil upon which their very existence will depend. Conservation of soil fertility through the wise management of herds and flocks is one of the greatest services we can render to the future, and offers one means of atonement for the prodigal waste of natural resources of which the past two generations have been guilty.

It is my hope and indeed my belief that out of this effort in which the Institute of American Meat Packers is now engaging may flow great benefits, not only to themselves, but to all who have an interest in the combined industry, and to our common country as well.



L. D. H. WELD

Lecture II

THE PACKING INDUSTRY: ITS HISTORY
AND GENERAL ECONOMICS

BY

L. D. H. WELD



THE PACKING INDUSTRY: ITS HISTORY AND GENERAL ECONOMICS

By L. D. H. WELD

It is of course quite impossible to treat adequately either the history or the economics of the packing industry in a brief lecture. It will be my purpose, therefore, to touch primarily on some of the basic economic features of the industry, and to give only incidental attention to the history of the industry. Certain historical facts, however, help to explain the present organization of the industry and the position that it occupies in the economic life of the country.

In the early days, before the agricultural development of the Middle West began, live stock were raised along the Atlantic seaboard in close proximity to the consuming population. The converting of live stock into meat was a local, small-scale process. There was no need of large packing companies, any more than there is need of such companies today in England and France, and other European countries where live-stock production is carried on in the neighborhood of consumers.

The conditions which gave rise to the present organization of the industry originated when settlers in the Ohio and Mississippi valleys began to raise live stock. As eastern cities grew, live-stock produc-

tion on the Atlantic seaboard could not keep pace. Supplies had to be brought from points farther and farther away.

At first, live stock from more distant localities had to be driven across the country; then, with the advent of railroads, the animals were shipped alive in stock cars. During the middle of the past century, the traffic in live animals to the Atlantic seaboard became important. The first step in moving the industry to the source of raw materials was the development of pork packing in cities west of the Alleghanies. Cincinnati became the first important pork-packing center in the country. In those days—before, during, and shortly after the Civil War—the shipment of meat products over long distances was confined entirely to cured products and principally to pork products. Pork was salted down and packed in barrels, and hence arose the name “the packing industry,” a name which is more or less a misnomer today and one which really applies much better to industries like fruit and vegetable canning where packing in containers is an important feature.

The great thing that held back the development of the packing industry in the Middle West was the impossibility of shipping fresh meats for considerable distances. It was realized that the shipment of live animals for great distances resulted in cruelty, that there was waste from shrinkage and deterioration, and that it was uneconomical to pay freight on the

whole animal. It naturally followed that attempts were made to find a way to ship fresh meats for long distances, and from these attempts came the refrigerator car. The first successful experiments were made about 1870, and the natural result was the rapid development of meat-packing companies in Chicago and other Middle Western cities.

At first there was a decided prejudice against western meats in the eastern markets, a prejudice that still lingers today in some of our eastern cities where a few people still have a preference for "city-killed" meats.

There were other obstacles, such as the opposition of the railroads, which had equipment of live-stock cars, and of eastern stockyards interests and other industries that had grown up in connection with the feeding and the shipment of western animals by rail to eastern markets. The opposition on the part of the railroads was so keen that the Chicago packing companies had to provide their own refrigerator cars. They still continue to operate them today, and as they have developed this part of their business they have built up transportation departments which keep track of the cars, which see that they are properly repaired, and which give the expert service that these special refrigerator cars require. The meat companies pay the railroads the regular freight rates on the products shipped and they receive a mileage rental from the railroad companies for the use of the cars.

During some periods this mileage rental has yielded a profit to the packers from the operation of refrigerator cars; at other times it has resulted in a loss. This whole matter is now under the control of the Interstate Commerce Commission, and mileage rentals are adjusted from time to time in accordance with the cost of maintaining and operating the cars.

With these obstacles overcome, the industry, centering in Chicago, began to grow rapidly. This was during the seventies. It was inevitable that it should develop, but its establishment was hastened by the fact that certain men of unusual ability entered the field. P. D. Armour, G. F. Swift, G. H. Hammond, Nelson Morris, and several others are names that stand out in the early history of the industry in the Middle West. Live-stock production spread to the Northwest, the West, and the Southwest, and consequently additional packing centers grew up, such as those at St. Paul, Omaha, Sioux City, St. Louis, Kansas City, Denver, Oklahoma City, and Fort Worth. Live animals still have to be shipped some distance, in many cases, to reach these centers. Packing-houses cannot be distributed too much throughout the actual producing fields, because they would be too small for economical operation, because the live-stock supply would be too seasonal and not of sufficient variety in kind and quality of animal, and because the labor supply and shipping facilities would be inadequate. One may rest assured that in the

locations of packing-houses today the most economical balance has been brought about between producing areas and consuming sections.

DEVELOPMENT OF STOCKYARDS

Along with the development of the packing industry in the Middle West, there grew up important live-stock market places, known as stockyards. There are two principal ways in which packing plants can obtain their raw material: first, by sending buyers out to the farms and ranches; and, second, by buying in the central stockyard markets to which country shippers consign their stock in the care of commission men. Where there is a large and continuous supply of live stock available, and where there is sufficient packing-house capacity to buy from day to day and to adapt production and selling programs to fluctuating live-stock supply, the stockyards method is much more satisfactory than to send buyers into the country. As a general rule, it is a more economical method of assembling, and the live-stock shipper can always be sure of getting cash at the going market price. This is the method used in the Middle West, and the commission men, together with their organizations, known as exchanges, have played an important part in developing these market places along efficient and honest lines.

In the East and South and Far West, live-stock supplies are too small and intermittent, and packing

facilities are too inadequate, to furnish a constant and ready market; hence, country buying has to be resorted to. The Far West is apparently just emerging from this stage. A public stockyards has been organized in Los Angeles, but many live-stock producers are opposed to this innovation, believing that they get better prices when the packers send buyers to their ranches. It is probably too early to decide whether conditions on the Pacific Coast are ripe for the development of public stockyards.

THE ORGANIZATION TODAY

From this brief historical sketch we can now take a bird's-eye view of the industry as a whole. In the first place, because of the fact that two-thirds of the live stock is raised west of the Mississippi River, and because two-thirds of the population is in the eastern part of the country, some agency is needed to convert live stock into meats in the live-stock district and distribute the meats in consuming markets hundreds of miles away. This is a business which cannot be done successfully on a small scale. Live stock have to be handled in large numbers in order to keep down production costs and to eliminate waste. Live-stock products have to be shipped in carloads and trainloads for successful long-distance shipment, and an extensive distributing organization has to be provided in order to get meats into the hands of retailers and consumers in the best of condition. This is the

reason why the large packing company has developed in the United States. This is the reason why large packing companies have developed in the Argentine, except that in the Argentine the cattle country is several thousand miles distant from European consumers. whereas the American packers have their principal market within a thousand or fifteen hundred miles.

It has already been suggested that if live stock were raised where the people live there would be no need of the large packing companies. As a matter of fact, some live stock is raised in every state; consequently, there are smaller concerns which handle local supplies of animals and sell in local markets. The United States Census of 1919 reported 1,304 packing establishments. Every city of any size has local plants. Every country town has local butchers that handle local live stock for village consumers.

We therefore have a limited number of very large companies, whose principal reason for existence is found in the fact that they can best do the long-distance business; then there are the medium-sized companies, many of them doing a business of from ten to twenty million dollars a year or more, which specialize on local business but many of which do a considerable interstate business; and then there are the thousands of country butcher-shops which come in competition with both the medium-sized packers and the very large houses. From the standpoint of

the public, the present organization is undoubtedly a fortunate one. On the one hand, we have all the benefits arising from large-scale production and marketing, and on the other, we have the benefits flowing from competition. The large packers are in active competition with each other; the medium-sized packers also compete with each other; so do local butchers in their respective communities. And all three classes of packers are in competition with each other. Each class of packers is necessary; each will endure.

It is interesting to observe that although there was a tendency before and during the war for the large packers to handle an increasing proportion of the total live stock of the country, there has been a distinct tendency in the opposite direction since 1919. In that year, the five large packers together handled 69 per cent of all animals killed under federal inspection. In 1922, the percentage had dropped to 59 per cent, a very substantial decrease. This has been due, in part, to the fact that small houses do not have to go to the expense of developing widespread sales organizations which are necessary in doing a long-distance business. It is also due to the high freight rates, which have militated against long-distance shipment. And, in some cases, at least, smaller packers have been able to keep down their expenses through lower wages and longer hours.

SIZE OF THE INDUSTRY

The packing industry is often referred to as the largest and most important single industry in the United States. It is true that in the census classification of industries the slaughtering and meat-packing industry has a larger volume of sales than any other. Its sales in 1919 were more than four billion dollars. The next most important industry was iron and steel, with sales of less than three billion dollars. Automobiles came third, with sales of nearly two and one-half billion dollars. But this does not tell the whole story. For its enormous volume of business, the packing industry needed a little over a billion dollars in capital; the iron and steel industry needed over two and one-half billion; the cotton manufacturing industry, with half the volume of sales, required a capital investment half as large again as the packing industry.

Again, turning to the number of wage-earners employed, the packing industry required in 1919 only about 160,000; the iron and steel industry, 375,000; and the cotton goods industry more than, 400,000. The packing industry is therefore the largest only in the sense that the value of its products is the largest. From the standpoint of capital invested and wage-earners employed, there are other industries ahead of the packing industry. But the value of products is an important consideration, especially when the products are used every day by almost everybody

in order to maintain life. From this standpoint, the packing industry is the largest and most vital industry in the country.

HOW PACKING INDUSTRY DIFFERS FROM OTHER INDUSTRIES

Now that we have compared the packing industry with other industries in point of size, let us see in what important respects this industry differs from other industries. In the first place, the packing industry is not one where various raw materials are brought together and assembled into a single finished product. On the contrary, the raw material purchased by the packing industry is already a rather highly developed organism, and the manufacturing process consists of breaking up the raw material into various parts, resulting in a considerable diversity of products. This has a marked influence on the operating methods of the industry, the accounting methods, and the sale of products.

For example, in accounting, by-products cause complications. When the packer buys a whole steer for one hundred dollars, what is the cost of the loin, of the hide, and of the hoofs? Each is a different product and brings a different price. The ordinary textbooks on accounting give very little help in solving this problem. The industry has had to develop its own methods, with the primary object of determining the value of the meat, which is the principal product.

Then, again, this diversity of products complicates the marketing problem. The packer cannot sell bacon, hides, and fertilizer through the same trade channel. He has to develop separate specialized sales departments to sell these different products. Some are sold direct to retailers, some to wholesalers, and others go direct to manufacturers who use his products as their raw materials.

Although different outlets have to be found for the various products, the principal marketing operations of the packer have to do with the sale of meats. During the early days of concentration of the packing industry in Chicago, cured meats were sold largely through brokers and wholesalers. There even developed in the Chicago Board of Trade a system of future trading in provisions. And this was extremely useful, both in furnishing a continuous outlet for the sale of pork products and in making it possible to reduce risks by hedging operations. As the packers began to develop their own distributing organizations, however, and as the demand for the old-fashioned salt pork declined, the packers came to rely less and less on the Board of Trade and to merchandise these goods themselves. Future trading in lard and provisions still continues, but it plays a much less important part than formerly.

As a rule, the packers, especially the larger ones, sell their meats direct to retailers. The reasons for this are as follows:

When western packers first began shipping western meats to eastern markets they found that direct sale was one way of combating the prejudice against western meats. Eastern dealers were not sympathetic; so in some cases the packers took these eastern wholesale dealers into partnership with them in order to obtain their co-operation as well as established outlets for their products. The perishability of meats has also made it desirable to sell direct to retailers so as to avoid unnecessary handling and to expedite the process. Another reason lies in the fact that in order to market perishable meats successfully, it is necessary to keep in closest possible touch with the changing market demands, so that each city may receive just the amount of meat it needs. This can be done better by coming in direct contact with retailers than by selling through wholesalers. Finally, so far as the large packers are concerned, they have sufficient volume of business to maintain branch distributing houses at extremely low operating costs.

The distributing organizations that have been built up by the large packers in order to reach retailers all over the country are very extensive and perform a more thorough marketing service than perhaps can be found in any other industry. Large cities and towns, together with territory immediately surrounding them, are reached through branch distributing houses that have already been referred to. These branch houses are equipped with artificial refrigera-

tion; each has its manager and corps of salesmen, meat handlers, and accountants. Most of them also have delivery equipment, so that the goods are carried to the very door of the retailer.

There are many thousands of towns, however, that cannot be reached by these branch houses, and sale is made direct to retailers in such towns by making direct shipments from the packing plants. A salesman calls on retailers in towns along a certain line of railroad and sends his orders to his home office. The goods are then loaded into refrigerator cars, which make regular trips over regular routes once or twice a week. These are known in the industry as "car routes"; outsiders sometimes call them "peddler" cars.

Through these two methods, large packers reach practically every railroad town in the country and even many towns, ranches, summer hotels, etc., which are some distance from railroad stations. As a matter of fact, it might be said that the large packers are engaged more in distribution than they are in manufacturing; at least more than half of the expenses of the meat part of their business are for freight and selling.

FLUCTUATIONS IN LIVE-STOCK RECEIPTS

Another feature of this industry is that it has practically no control over the purchase of its raw material. This is not so true of the small packer as

it is of the large, and not so true in those parts of the country where live stock is not produced in large quantity and where there are no public stockyards. But the large packing companies, located in the principal live-stock centers, have to purchase all the live stock that is shipped to market, and the receipts at these markets vary enormously from season to season, from month to month, from week to week, and even from day to day. The cotton manufacturer can buy as much or as little raw cotton as he wants, and he can buy whenever he wants it. Not so with the packing industry. The supply of live stock depends upon the shipments of farmers, and over these shipments the packer has absolutely no control. He never knows from week to week how many animals he will handle during the following week, or the number of people he will need to employ. Consequently, he cannot plan ahead as to how much meat he will ship or how much he will be able to sell through his sale outlets.

The fluctuating prices that are caused by the varying supply of live stock not only result in unfortunate uncertainty to the packer, but also irritate the live-stock producer, who never knows for sure just what price he will obtain when his shipment reaches market. Sometimes he strikes a falling market and thinks that somebody has artificially depressed the price. Just as often he strikes a rising market, and has no complaint to offer.

Another way in which the packing industry differs from most other industries lies in the fact that a meat packer cannot set a price on his product. This applies especially to fresh meat, which is a highly perishable product and which has to be sold by the packer within a couple of weeks after the live stock is purchased. It is true that beef can be held for a month or longer before it is finally consumed, and the best steaks and roasts are held for that length of time. This is a common practice with restaurants and hotels.

Perishability of fresh meats is one of the fundamental facts of the industry. Meat cannot be stored away in cold storage as can butter and eggs and poultry. True, it can be frozen hard and kept indefinitely, and this was done during the war for foreign shipment. But the American trade does not use frozen meat, and not 5 per cent of the meat is frozen and stored.

Because of its perishability, fresh meat has to be sold for whatever price can be obtained. The Chicago packer, shipping carloads of beef to New York, cannot instruct the New York manager to hold out for a certain price. The price depends on the conditions at the time the meat is offered for sale. After taking a week or more to get the meat to New York and ready for sale, there are only a few days leeway in which the final sale can be made.

There is more leeway in the case of cured pork products. These spend several weeks in the curing

process and are not so perishable as fresh meats. They can be held long enough to even out the supplies throughout the year, and this is a fortunate thing for both the farmer and the consumer, because hogs are marketed in largest quantity during the winter, followed by a relative scarcity during the summer and early fall. But cured ham and bacon are available in sufficient quantity throughout the year. The prospective demand for ham and bacon keeps up the price of hogs to the farmer during the winter months. The stored product, available during the summer, keeps the price to the consumer within reason.

HOW PRICES ARE DETERMINED

Consideration of the foregoing characteristics of the packing industry naturally lead one to ask, How are live stock and meat prices determined? There are a great many ideas on this subject. Many live-stock producers believe that the packers have it in their power to raise or lower the prices of live stock at will. There are many who believe that the packers have this same power over meat prices, and that they can widen the margin between live-stock prices and meat prices as they see fit. There are also those who think that the price of meat depends on the price paid for live stock.

All of these theories are wrong. On the other hand, it is not a simple matter to state in a few words the principles underlying price determination. The

fundamental facts, however, are that live-stock prices, at any one time, depend primarily on the value of meat and by-products. Meat is by far the most important product, and its value becomes adjusted through competitive bidding in open markets at such a point as to just move the available supply into consumptive channels.

Demand for meat plays an extremely important part. Since figures on live-stock receipts are published in the daily papers, everybody knows that the supply varies. But there is no such physical measure of the variations in demand. Even if the supply were made absolutely uniform from week to week, there would still be price fluctuations, because the demand for meat varies from day to day and in one market as compared with another. With a given supply of meat on hand at any one time, the packer who tries to hold out for half a cent above the going market price will have meat left on his hands; the packer who sells at half a cent under the going price will soon be cleaned out and will not have goods with which to take care of his customers. This price which just clears the existing supply, however, has to fluctuate from day to day, not only because of the changing demand which has just been mentioned, but because the available supply also varies from day to day.

There is probably no better example of the interplay of supply and demand than can be found in the

live-stock and meat markets. There is no market where competition plays a more important part. The price of one cut of meat may be rising while the price of another may be falling. The price of choice beef may be strong in Boston and weak in New York. The situation may change overnight. Some of these demand changes can be explained through weather variations, holiday seasons, etc., but many of them cannot be explained at all. The packer who sells his goods in distant markets has to keep constant watch of this changing demand, so as to know how to distribute his products among the various markets. To do this properly, he has to keep in touch with his outlets by telegraph.

The packing industry is one that has to be managed from hour to hour and from minute to minute. It cannot carry on in an orderly and quiet manner. It is an industry where one little crisis follows another in rapid succession. Careful attention to details and quick decisions on the part of executives are necessary.

This matter of demand has been emphasized because so many people think that price variations are caused almost entirely by changes in supply. Supply, of course, plays a very important part. If live-stock receipts are heavy, and the supply of fresh meat large, competition forces down the price of meat so that it will be consumed. Meat salesmen naturally try to get all they can, just as salesmen have to in

every line of trade, but they are also forced by competition to charge a low enough price to keep meat moving. The result is a fluctuating price that just clears the existing supply into consumptive channels. It follows, as explained above, that the price of live stock at any one time depends on the prices of meat and by-products, or, rather, on the prices that packers think they will be able to get when the fresh meats are offered for sale a few days later, and when the cured meats and by-products are offered for sale a few weeks or months later.

One corollary of this explanation is that when by-products fall in value, as, for example, when hides fell in 1920 from fifty cents to ten cents a pound, the immediate result is not an increase in meat prices, but rather a fall in live-stock prices. Meat prices could not be increased, because then the meat would not all be consumed. Unfortunately, the farmers have to suffer because the value of live stock depends on the products that can be obtained therefrom. Of course, if, in the long run, live-stock prices remain so depressed as to discourage production, then the supply of meat and by-products becomes smaller and the prices of both live stock and live-stock products have to rise again.

PROFITS

Closely allied with the question of prices is that of profits. There are two important ways in which the profits of an industry may be stated: one is to

compare the profit with sales, and the other is to compare it with investment. The stockholder is more interested in the profit on investment, because that measures the ability of the business to pay dividends on stock. The seller of raw material and the user of the finished product, however, are, or ought to be, primarily interested in the profit per dollar of sales or per pound of product sold. The belief that high meat prices or that low live-stock prices are due to profits taken by the packer is completely disproved by the mere statement of the profit per pound of product or per dollar of sales.

For the nine-year period ending with 1921, certain leading packing companies together earned from all sources an average profit of 1.3 cents per dollar of sales. This amounted to a very small fraction of a cent per pound sold, and obviously had practically no effect on prices, and it is for this reason that the packers have so frequently called attention to the fact that their profit is such a small percentage of the selling price of their products.

The packer, however, turns over his capital five or six times a year, and during the same period this 1.3 cents per dollar of sales amounted to 6.2 per cent on the investment. This hardly seems like an unfair return on stockholders' investment, especially when it is found that the average return for over three hundred corporations in all industries for the same period was 8.5 per cent on the investment.

During the war years, the packers made a larger profit than usual, but no larger profit than that made by industry in general. But this profit in the packing industry was not earned in cash and distributed to stockholders; it was principally a bookkeeping profit, resulting from rising values of inventories. The managers of the industry knew that sooner or later there would be a corresponding decrease in inventory values, and that it was necessary to build up surpluses in order to take care of inevitable losses. Their fears were not ill founded. The years 1920 and 1921 were very hard ones for the industry. In 1921, the five large packers lost an aggregate of about \$60,000,000. Only during 1922 did the industry get back to something like a normal basis.

Why is it, then, that the price of meat is so high as compared with the price of live animals? We have seen that the packer's profit has practically no effect; and the packer is supposed to be most efficient in his plant operations, so that expenses must be as low as could be expected. Here again a simple answer cannot be given in a few words. Some of the fundamental facts are as follows:

In the case of cattle, only a little over half the animal is meat, so that a large part of the cost of the animal has to be distributed over only about half its weight. During recent years, the cost of converting and of marketing has increased. Hourly wage rates are more than twice as high as they were before the

war. Freight rates have increased; selling expenses are also much higher than they were a few years ago. But, even so, the packer pays, say, ten cents a pound for cattle and sells a whole side of beef for from sixteen to eighteen cents a pound. This price difference varies at different times with various factors. After the retailer has bought a side of beef, he has an operating cost of around 20 to 25 per cent of his sales. The different cuts of meat are really different individual products. In order to average out from twenty-five to thirty cents a pound for the whole side of beef, the retailer undoubtedly has to charge fifty cents a pound or even more for the porterhouse. Unfortunately, only one-quarter of the beef, and, hence, only a little more than one-eighth of the live animal, consists of loin and rib. These are the parts that are in greatest demand, and the demand for them has been greater than ever since the war. The stewing cuts, as good as they are when properly prepared, bring a relatively low price. It is therefore obviously unfair to compare the price of a single cut of meat with the price of the live animal. When the average price of all cuts together is considered, it is found that there is no such spread between the prices of live animals and the retail prices of meats as many people imagine, and that such spread as exists is due primarily to necessary expenses of packing, shipping, and merchandising, and only incidentally to profits obtained by the packer and the retailer.

RELATIONS WITH THE PUBLIC

If all these facts are true, one naturally wonders why a prejudice ever developed against the packing industry, why it has been investigated and investigated, and why Congress has felt called upon to pass a law providing for regulation of the industry. The trouble is that although these facts are true, the public did not and does not know them, and that it has been only within the past very few years that the industry has begun to tell the public the facts.

Congressional investigation of the packers began as early as 1889. In 1902, there was a serious agitation based on the belief that the large packers had pooling arrangements which resulted in artificial manipulation of prices. As a matter of fact, the large packers had had a co-operative arrangement for several years, whereby it was decided from week to week just how much fresh beef would be shipped by each packer into each of the large eastern markets. The object of this arrangement was to keep the different markets evenly supplied, thereby to prevent gluts and scarcities. The courts reviewed the situation and issued an injunction, prohibiting combination in restraint of trade, but permitting the continuation of the existing arrangement. The packers, however, discontinued their co-operative arrangement voluntarily, believing that the public would not understand the benefits derived from control of shipments and believing that the agitation

would continue. Other than this, there has been no sort of arrangement among the packers for the division of live-stock receipts, for the division of trade territory, or for the control of shipments. Furthermore, the arrangements prior to 1902 did not attempt to control prices, and in no way amounted to an unfair restraint of trade.

But agitation continued. The Bureau of Corporations made an investigation of the industry in 1904 and 1905 and reported, after making a careful examination of the packers' books, that the profits were small and had practically no effect on prices. The Bureau of Corporations had been too scientific and impartial to suit those who made political capital out of unfair criticisms of the packers; so the agitation went sweetly on. Upton Sinclair's book, *The Jungle*, appeared at about this time. It greatly exaggerated the conditions existing in the industry. Later, an investigation was conducted, and the scope of the Federal Meat Inspection Act was extended to cover sanitary conditions in the premises where federally inspected meat products were prepared.

Then came the "immunity bath" case in 1906. The packers, accused of violation of the Sherman Antitrust Law, naturally took advantage of their legal rights in defending themselves. Their first defense was that information on which the case was based had been obtained in such a way as to grant

them immunity from prosecution and the court decided that the packers were right. This decision, however, may have increased suspicion against the industry, because there were those who thought that the packers' defense indicated that there were certain practices that they wanted to cover up.

Then came the great case of 1912 when the packers on a criminal charge and after a jury trial were declared not guilty of restraining trade. But even this did not satisfy the demagogues and professional agitators; for the whole matter broke out again within five years.

Then came the culminating attack on the packing industry through the investigation and report of the Federal Trade Commission. It is well known now that the Trade Commission made an unfair and biased investigation; that it held *ex parte* hearings, where witnesses who were prejudiced against the industry were permitted to testify; that in preparing its report the Federal Trade Commission suppressed evidence which was favorable to the packers and even selected individual items from letters and telegrams in order to prove certain contentions, omitting other items from the same letters and telegrams which disproved these contentions. It is not surprising that the conclusions of the Commission were unsound and that its recommendations were of no value whatever.

Then came the demand for punishment and for government regulation. Inspection of data collected

by the Federal Trade Commission by special attorneys employed by the Attorney-General and a Grand Jury investigation failed to provide grounds for an indictment. Nevertheless, considerable public sentiment had been aroused by the publicity given the report of the Federal Trade Commission, and in order to allay this feeling the packers agreed to a most remarkable action, known as "The Consent Decree." This decree specifically said that the packers are not adjudicated guilty of unlawful acts and that the action of the packers does not constitute an admission of guilt. The decree goes on to prohibit certain practices that were already prohibited by law, and in which the packers were not indulging. It also prohibited the five large packers from handling canned fruits and vegetables and other grocery products, and from owning retail stores. It also required them to sell their interests in the stockyards. In other words, this remarkable decree prohibits the packers from doing certain things which are absolutely legal to do, and for which there is ample economic justification.

Finally, there came the Packer and Stockyards Act passed by Congress in August, 1921. This does not contain some of the radical features that were included in earlier bills, but it gives the Secretary of Agriculture rather wide powers of regulation. Many of us have believed that the establishment of government supervision of the packing industry is fraught with grave dangers. Whether or not it harms the

industry depends upon how the law is administered. So far, it has been administered in an impartial and constructive way, but one dislikes to contemplate what might happen if during future political changes the administration of the law should fall into the hands of prejudiced, unfair, and unscientific men. There is also danger that when it is discovered that the present law does not raise the price of hogs or lower the price of pork chops, there will be a demand for more drastic legislation. We are afraid that the gradual starvation process which has been applied to the railroads might possibly be applied to the packing industry.

The regulation of this industry is also of great importance to the business world in general. The packing industry is the first private industry that has been singled out for government regulation. Will the government stop here? Why not pass laws to regulate the flour industry and the steel industry? It was supposed that the public became sick of government regulation and operation during the war, but the demand for regulation still seems to be on the increase. Experience with government regulation of railroads, however, has not been such as to inspire confidence in its results in other industries, if government interference is extended so as to curb private initiative in industrial management.





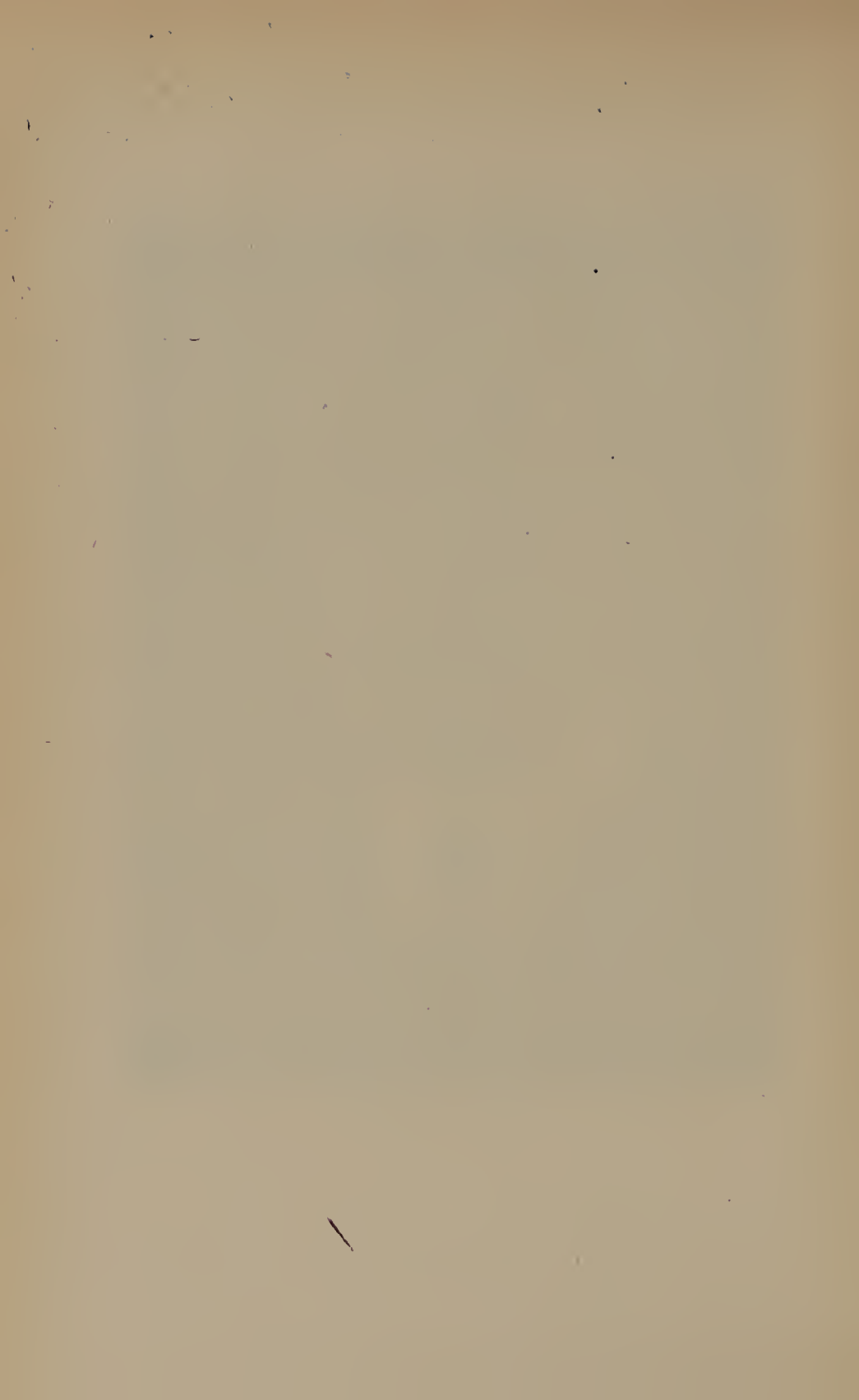
ARTHUR CUSHMAN

Lecture III

THE PACKING PLANT AND ITS EQUIPMENT

BY

ARTHUR CUSHMAN



THE PACKING PLANT AND ITS EQUIPMENT

In studying any phase of any industry one should go back to the beginning of that industry, or at least to a point in its development which shows a tendency toward standardization of operations, note the contributory causes of its development, and trace the changes step by step. It is unfortunate that we lack the time to follow such an outline exactly in this discussion of the packing plant and its equipment.

The dressing of live stock for the preparation of human food no doubt had its beginning in the Garden of Eden, and the meat business probably antedates the clothing business. However, I have no desire to take you back to the Garden of Eden in this lecture, but I should like to consider with you a few of the great influences behind the development of the meat-packing plant, from the slaughter-house period to the present.

Before the Civil War, the American people lived in relatively small communities, and were easily and abundantly fed from the products of the farms surrounding these communities, so that each community was self-sustaining, so far as food was concerned. Live stock, for the most part, was dressed for immediate consumption, although some pork

products were cured during the fall months for winter use.

There was virgin soil in abundance, and commercial fertilizers were not needed; consequently they were not manufactured. There was good demand for lard, but, with the exception of the inhabitants of the few large cities, families rendered or "tried out," as it was called, their requirements of lard from product of their own killing or raw product purchased from farmers or local butchers. There was farm-churned butter in abundance; consequently, there was no demand for a substitute; and oleo and neutral lard departments were unknown to the slaughterer. He had no use for, or interest in, the refining of greases, the manufacture of glue and gelatin, or any of the similar present-day packing-house products. He was primarily a slaughterer of live stock. Because of these facts, I should like to refer to this period prior to the close of the Civil War as the slaughter-house period in the packing industry of the United States.

The slaughterer, in order to satisfy the rapidly growing demand for meat. summer and winter, began curing hams and bacon on a large scale, graduating from the class of slaughterer to the class of meat packer; for he packed meat in salt to preserve it, so to carry it from the fall and early winter months, when the supply of live hogs was ample, to a later period when the supply was not so great.

Preservation by salt alone, however, was not sufficient. The late spring and summer heat constituted a problem that had to be overcome. By 1870 the larger plants were using natural ice to refrigerate rooms for fresh and cured meats. Chambers with communicating air spaces were built over the rooms to be chilled. Cakes of ice were placed in these chambers, the whole resembling in principle a domestic ice box or refrigerator.

At the time, the greatest problem of the packer seemed to have been solved ideally, and natural-ice refrigeration remained the only method of refrigeration in general use until about 1890; and as many radical changes and developments were made possible, and yet limited, by natural-ice refrigeration, it might be well to designate the twenty-five year period of development, from 1865 to 1890, as the period of natural-ice refrigeration.

For many years prior to 1890, scientists had been producing cold in their laboratories mechanically; and, in an experimental way, refrigerating machines were in use in breweries. However, practical refrigerating machines did not come into general use in the packing-house until about 1890; and as the development of mechanical refrigeration, with freezing temperatures, has continued to have a paramount effect upon the development of the packing plant, we shall refer, for comparative purposes, to the period post-dating 1890 as the period of mechanical refrigeration.

We now have the development of the meat-food plant divided into three periods: first, the slaughter-house period; second, the period of natural-ice refrigeration; third, the period of mechanical refrigeration. Each of these periods might be consistently divided into one or more subdivisions, to designate distinct development in some of the specialized branches of the industry, but as volumes could be written upon this subject we can hope at this time only to sketch some of the important contributions which have made the modern packing-house possible; hence, this general classification will answer our purpose.

SLAUGHTER-HOUSE PERIOD

We really are not very much interested in the development during the slaughter-house period. That our forefathers were well fed is self-evident. Many of our strong men had their beginning in the butcher business, and it will be remembered that the father of John Harvard, one of the founders of Harvard University, was a prosperous butcher in England during the slaughter-house period.

PERIOD OF NATURAL-ICE REFRIGERATION

As before mentioned, without refrigeration, meat packing could not be carried on during hot weather, so that until about 1870, it was a winter business. With the introduction of natural-ice refrigeration, plants could be forced to a certain degree during the

periods when live stock was naturally ready for market, either summer or winter, and cured products could be carried several months with safety into periods when the supply of live stock was smaller. Distribution of product had been confined to areas

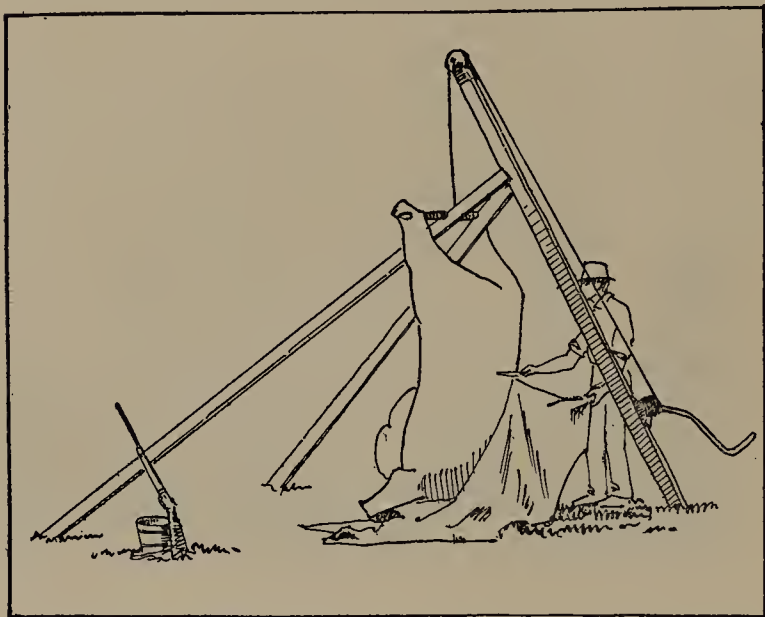


A typical slaughter house during the latter part of the slaughter-house period.

immediately surrounding the plants, but with moderate temperature control, curing troubles were reduced, and packers began reaching beyond their immediate territories with cured products. Plants located along the Atlantic Coast found a ready market in England and the southern seaboard states. The cured products, packed in salt, were trucked to the

docks and stored in the hold of the vessel where the temperature was low enough to carry the products to their destinations in safety.

Compared with the present-day standards, packing-house methods at the beginning of this



Method of dressing cattle in the field during the slaughter-house period and on the ranges today.

period were crude indeed. Muscle and brawn were the prime requisites of the butcher. The carcasses were raised to the dressing rails by man power; hides were removed with but one idea—to get them off as quickly and easily as possible, and scores, cuts, and pattern were not recognized. Hogs were scalded

in caldrons heated with wood or coal fires, and the hair was removed entirely by hand. The primal parts—that is, those parts that enter the trade, as fresh pork, bacon, hams, and shoulders, and so forth—often cut while the carcass was still warm,



Inspection of hide for cuts, scores, and pattern in a modern packing establishment.

were placed on shelves to cool or in chilled pickle for curing; trim and taints were of little concern in the earlier days of this period. Lard was tried out in open kettles and sold unrefined, and unrefined it was, for free fatty acids and rancidity, the arch enemies of fats and oils, meant nothing to the sturdy pioneer.

As there was still plenty of virgin soil, animal fertilizers were not needed, and the refuse from the kettles, with the hair and viscera, were burned or buried, dumped into rivers offering adequate drainage, or on the shores of the ocean where the ebbing tides carried out to sea products which today have considerable value.

It would seem to some of us that the packers of the seventies had rather an easy time, but investigation shows them working in their plants from dawn to sundown, using candles and lamps to light the darkened rooms. Electric lights had not yet been put into common use. There were no telephones, no typewriters, nor stenographers. Theirs was a great responsibility, and they seemed to sense the importance of it.

The great farming lands of the Middle West began to attract families from the East, where the cities were growing rapidly from immigration. Cincinnati had been the center of the corn belt, and, consequently, the live-stock center of the United States; but, as the population and railroad facilities increased, the corn-belt and live-stock areas moved westward, followed by the packing plants, which were located near their source of supply, Chicago soon became the center of the packing industry.

Eastern packers could no longer adequately supply the demand for fresh meat, and it devolved upon the western packer to find the ways and means

of meeting this demand. He was not found wanting, and after taking great chances, finally succeeded in shipping fresh beef to eastern cities in cars refrigerated with natural ice. This solved one of the greatest problems of our rapidly increasing urban people. Fresh beef from the West was delivered in New York in good condition, and sold on the market for less than the home-grown product. Revolutionary developments in the packing-house followed the adoption of the refrigerator car. Fresh and cured products could now be shipped from Chicago in direct competition with eastern packers, and the western plants began to grow at an enormous rate.

No standards had been set for the designing and building of packing plants. Each operator worked out his own problems and designed his own plant additions, and guarded scrupulously all changes in methods; consequently, in the early years of the period, no two packing plants were quite alike. Few plants slaughtered both cattle and hogs. Some plants were built entirely of wood, while others had brick walls with interior structures of wood. Ice houses for the storage of natural ice in many cases occupied more than one-half the area of the plant. The insulation of the walls of refrigerated buildings was accomplished either by building parallel brick walls, each from one to two feet thick, with an eight- or ten-inch air space between them, or by furring the inside of the wall, sheathing with wood, and filling the

space so formed with dry wood shavings or sawdust.

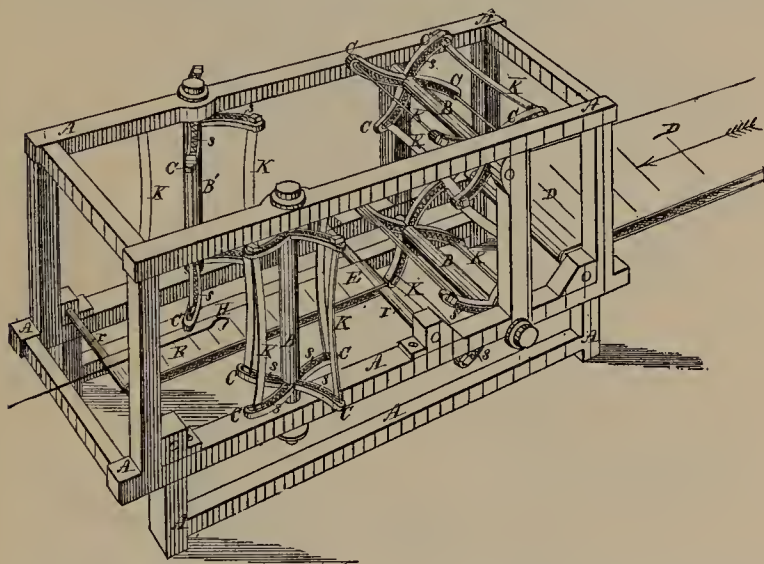
Packers soon became conscious of the inefficiency of their plants and methods, and began to devote much of their time to improvements, innovations, and labor-saving equipment. To scrape the hair from a



A typical plant during the latter part of the period of natural-ice refrigeration. Note how ice house occupies practically half the area of the plant.

hog by hand would be an irksome job today and it was just as tiresome fifty years ago. We owe a debt of gratitude to the men who labored to build a machine to do this work. In 1876, William W. Kincaid, of Chicago, received a patent for a hog-scraping apparatus. a horizontal machine having revolving reels placed vertically and horizontally. The connecting arms of the reel, acting as scrapers, were mounted in slots in the cross arms and were held outward, by means of springs, against the hog, which was pulled

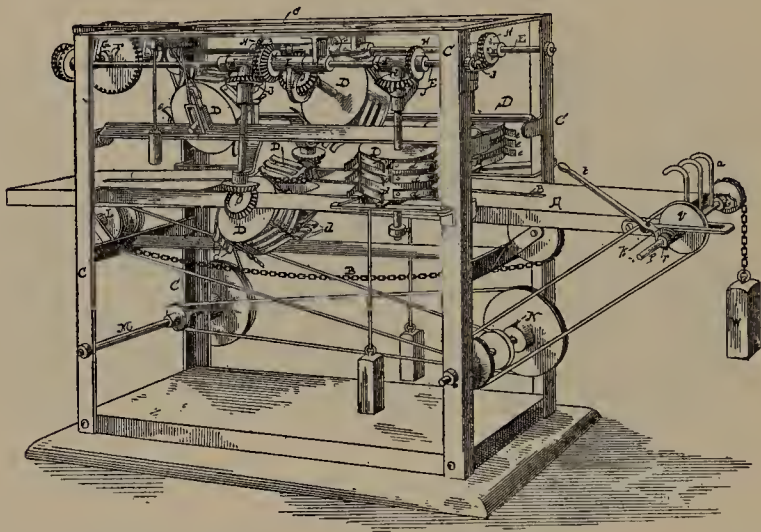
through the machine by a windlass or some other such means. In 1880, John Bouchard, also of Chicago, and a co-worker of Kincaid, received a patent for a hog-scraping machine. Bouchard's machine also was a horizontal device, but, instead of



The hog-scraping machine is one of the most important pieces of equipment in the packing-house. The machine pictured above is the Kincaid apparatus, invented in 1876.

reels, had metal spools, to which were fastened flexible steel scrapers. An ingenious transmission permitted the spools to move transversely, and counterweights held them against the hog so that they were free to follow the contours of the carcass. The hog was drawn through this machine by means of an endless chain. Modifications of the Bouchard machine were in use for many years.

In 1888, Cunning and Lowrie, of Indianapolis, received a patent for a scraping machine, the principle of which was entirely unlike the previous machines. A barrel, or cylinder, placed vertically had pivoted to its inner wall many steel arms tipped with steel

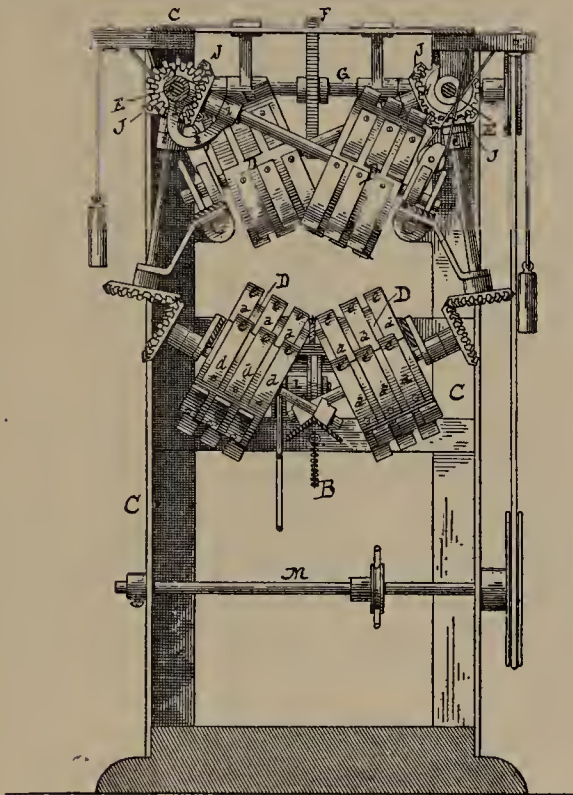


The Bouchard hog-scraping machine (side view) (invented in 1880).

scraping blades. Each arm was equipped with a coil spring to hold it against the hog which was pulled up through the machine by an endless chain. Improved types of this machine are still in use in a few plants.

Steel rails were erected in place of wooden ones formerly used for the purpose of moving dressed carcasses from one room to another, trolleys and short

gambrel sticks taking the place of extra-long wooden gambrel sticks which were pushed along on the wooden rails.

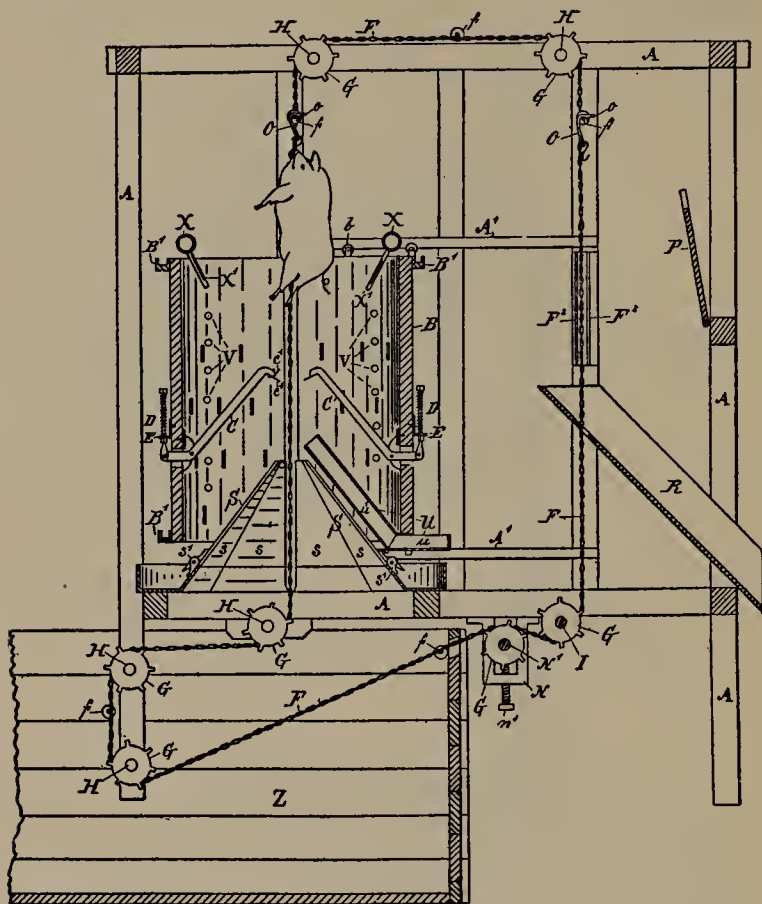


The Bouchard hog-scraping machine (end view)

Steam-pressure cooking tanks, or digesters, for rendering lard came into use, and greatly increased the production of lard.

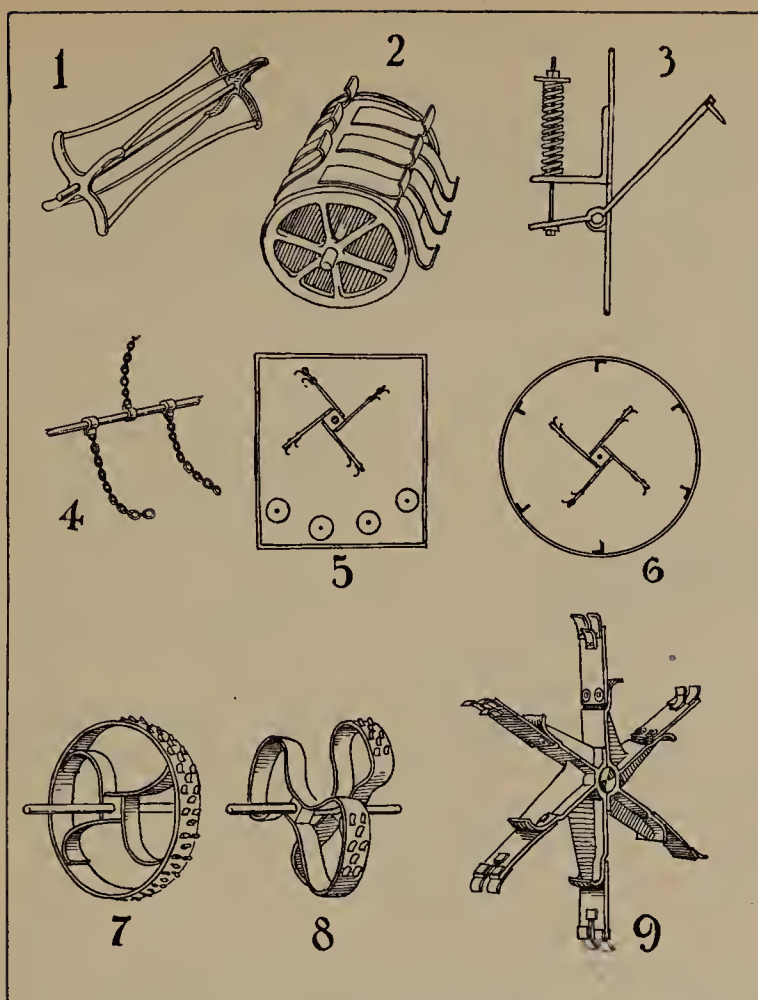
Midway through this period, attention was particularly directed toward supplying the demand

for fresh and cured meat. However, the sausage appetites of the European people coming to this



Cuning and Lowrie hog-scraping machine (invented in 1888)

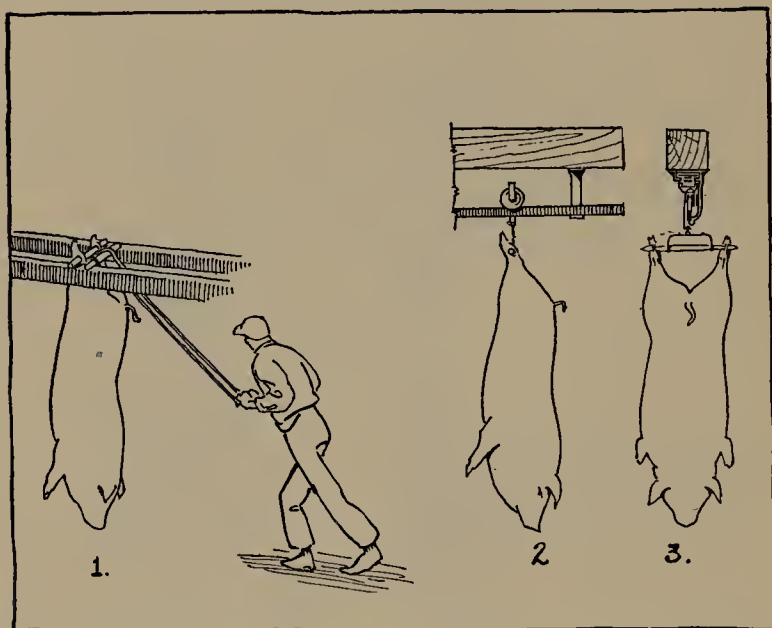
country had to be satisfied, and it naturally followed that since the packing-house produced the basic ingredients of sausage, it should have a sausage



Evolution of the hog-scraping element: (1) The Kincaid hog-scraping element. (2) The Bouchard hog-scraping element. (3) The Cunning and Lowrie hog-scraping element. (4) Chain attached to revolving shafts. (5) Scraper knives attached to rubber belting mounted upon revolving shafts, and installed in a machine having a screw conveyor. (6) Scraper elements installed in the revolving cylinder type of scraping machine. (7) Flexible wheel type of scraping element. (8) The loop type of scraping element. (9) Type of scraping element used in modern scraping machines.

department of its own. Gradually the manufacture of sausage became an important addition to the ever increasing packing-house operations.

All through this period, however, additions were made to plants along the lines of least resistance.



Evolution of the hog conveyor: (1) Hogs being pushed along wooden rails. (2) Steel rail and trolley without conveyor. (3) Steel rail and trolley with drop-finger conveyor.

Natural-ice refrigeration was found wanting. Refrigerated rooms were always damp and the range of temperature so limited, the ice harvest so uncertain, the transporting of ice into southern territories so expensive, and the general features of the system so

inadequate, that early types of refrigerating machines were installed during the eighties, in an experimental way in packing plants, and at the close of this period were recognized to be not only practical, but economical.

PERIOD OF MECHANICAL REFRIGERATION

The year 1890 found the packer committed to the use of mechanical refrigeration, and also to the large part science in general was to play in the development of his plant and manufacturing methods. He had seen the birth of the telephone, the electric light, and electric power, all of which had tremendously affected his business. A short time after the introduction of mechanical refrigeration, trained men, engineers, and chemists found favor with the packer, and contemplated improvements were studied from the scientific, as well as the practical, point of view.

The principles of mechanical refrigeration cannot be discussed in the space remaining. We all know that cold is produced mechanically, and where insulation and other structural conditions are favorable, any desired temperature as low as minus 10° Fahrenheit can be produced, and even lower if the necessity warrants the additional power cost.

It was the packer's business to apply the principles of mechanical refrigeration to his special needs. Salt brine was first chilled in tanks and pumped through open troughs or pipe coils installed in the discarded

ice bunkers, or hung from ceilings and walls in other rooms. At lower initial cost, the heat-absorbing elements of the refrigerating system, known as expansion coils, were installed directly in the rooms to be chilled, instead of cooling the rooms by the circulation of cold brine. With each of these methods, the pipes became rapidly coated with frost, insulating them and greatly reducing their efficiency; and the accumulated frost had to be removed at frequent intervals. That was a laborious task, indeed. As a relief from such a disadvantage, brine was made later to drip over the coils to remove the frost.

Fresh meat deteriorates very rapidly, and to check this deterioration the temperature of dressed carcasses must be reduced as rapidly as possible, without freezing. A very efficient refrigerating system is all important. The effectiveness of the systems which have been mentioned was in proportion to the superficial area of the pipe employed, plus the temperature of the brine, and had its limitations. In 1900, Horace C. Gardner, of Chicago, improving upon this method, developed what was known as the "sheet system," which, roughly, consisted of the installation of muslin sheets hung vertically and close together in the lofts above the coolers, cold brine being made to flow over these sheets in regulated quantities. The time required to lower the temperature of dressed carcasses to the desired point was reduced, and the labor and annoyance of de-frosting,

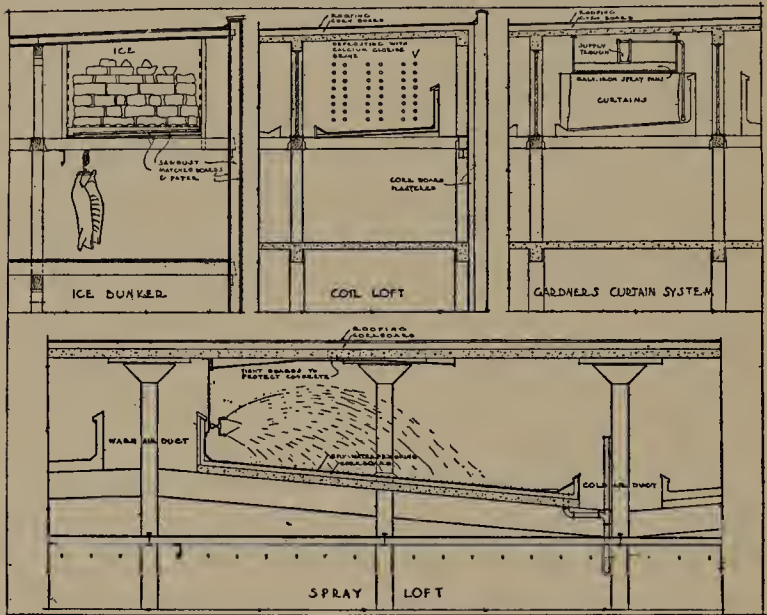
common with the pipe system, was eliminated. The new method also had the added effect of further conditioning the atmosphere, as the brine absorbed a very large proportion of the moisture rising from the warm carcasses.

Many years later, the so-called spray system of refrigeration was developed, consisting of spraying chilled brine into chambers above the coolers, almost completely saturating the atmosphere with finely divided particles of cold brine. Such a proceeding rapidly reduces the temperature, accelerates the circulation of air, and has resulted in still farther diminishing the time required to chill dressed carcasses properly by one-third to one-half. This system is in general use today.

The spray method has been also effectually installed in vertical ducts placed between columns for chilling areas on the same level. Spray nozzles installed in galvanized iron pipes, 8 or 10 inches in diameter, suspended horizontally from ceilings of rooms where condensation is bothersome, is an effective remedy.

The physics laboratory determined the insulating value of various materials. Sawdust and shavings were effective so long as they remained dry, but they have a strong affinity for moisture, and it was difficult indeed to keep them dry and prevent hidden losses. Granulated cork, which does not absorb moisture, was substituted, but wood sheathing still was used

to retain the loose cork, and did not long satisfy the refrigeration expert. Granulated cork, pressed and baked into sheets of varying thickness, later came upon the market and is today in general use. Whereas insulation, composed of shavings or wood



Evolution of refrigeration for hog and beef coolers

sawdust was often 12 inches in thickness, the same insulating value today is provided by cork board 16 inches in thickness, thus conserving 12 inches in the length and width of the modern refrigerated room. Cork board does not disintegrate, attract moisture, or have any of the other shortcomings of sawdust or

shavings. It is self-retaining, and when plastered with cement, is almost the last word in sanitation.

It is unfortunate that we must describe this most important phase of plant operation so briefly, for refrigeration is the heart of the packing-house organization, and upon its efficiency depends the functioning of the entire plant.

As the heart is dependent upon the lungs for its life, so refrigeration is dependent upon the power plant for its vitality. The plant superintendent formerly was interested only in the products being produced, and failed to keep pace with the rapid advancement being made in steam engineering. That he had plenty of boiler capacity was his principal concern, and many a dollar floated up the smoke stack while he was picking up pennies on the killing floor. Today the plant superintendent is expected to have a general knowledge of mechanical engineering. Flue gas analyses are made regularly to determine the condition of the fires and boiler settings. Coal is purchased upon the basis of its heat value, and not because it is cheaper than coal from some other mine, and pounds of water evaporated per pound of coal are watched as carefully as the yields of packing-house products. New equipment is purchased on the basis of its efficiency rating instead of on the basis of competitive price. The power plant, which was neglected in the past, is now the social equal of all departments, and in some plants is the aristocrat of them all.

The increasing demand for lard engaged the attention of the packing-house operator toward increased production, improvement, and uniformity in



Lard-chilling roll

quality. William B. Albright, of Chicago, will be remembered as an outstanding figure in the scientific and practical development of methods and equipment used in lard and oil refineries of the packing business. His development of the lard-chilling roll was an

accomplishment worthy of our attention. Formerly, the hot lard was chilled by slow agitation in jacketed kettles, cold water being circulated through the jacket to reduce the temperature to the desired point. This method required a great amount of time and an abundance of water. The lard roll used today consists of a large cast iron cylinder in which is circulated cold water or cold brine as the cooling agent. In improved types, direct expansion of ammonia is often used as the cooling agent. The hot lard is brought in contact with the outside surface of the cylinder, which, revolving, picks up over its entire surface a thin layer of hot lard, and in one revolution chills it to the desired point. A steel knife or plow scrapes off the chilled lard, from which point it is collected and pumped into shipping packages. By regulating the flow of lard and the chilling agent, it is possible to control the color and consistency of the finished product. In addition to the value of absolute control over the consistency of chilled lard, the roll has reduced the time of chilling to at least one-third the time formerly required.

The engineers and packing-house mechanics have made improvements in mechanical equipment too numerous to mention. For instance, the hog-scraping machine mentioned previously has been superseded by machines having scraper knives attached to rubber belting, which in turn is mounted upon steel shafts, and, flying out at a tangent as the

shafts revolve, scrape practically all the hair off the hog. This type of beater, though resembling previous types, has a longer life, and today is used in several different types of dehairing machines.

It is probably necessary to explain here the reason for giving the outline of the story of the development of the hog-scraping machine to the exclusion, almost, of other interesting machines employed in the packing plant. The hog-scraping machine is the key machine in the pork department; and as there is little special machinery in the beef department, it might be said that it is the most important machine in any of the major departments of the entire plant, exclusive, of course, of motive power and refrigeration. At another time, each department will be discussed and then the equipment which must be neglected in this discussion will be described. I refer to the special equipment used in the processing of so-called by-products, special machinery and equipment used in the manufacture of sausage and butterine. This last-mentioned department, although not found in the average packing plant, is an important factor in many of the very large plants.

With the exception of the specialty and by-products departments, there is a surprising scarcity of automatic equipment in the packing plant. The very nature of the raw material, as well as its construction and size, makes treatment with automatic or special machinery difficult, but we are quite

accustomed to seeing what seems to be the impossible become an actuality, and we can look forward with confidence to further improvements in the development of automatic equipment applicable to every



Dressing cattle on the killing bed where carcass remained in practically one position during dressing process.

department of the plant. Here still lies a very fertile field for the mechanical genius.

Packing-house chemists, assisting the practical men, have devised methods of reclaiming former wastes, producing fertilizer, stock food, glue, gelatin, and other products. It was the chemist who, aided by the bacteriologist, pointed out the way to properly control souring in meats.

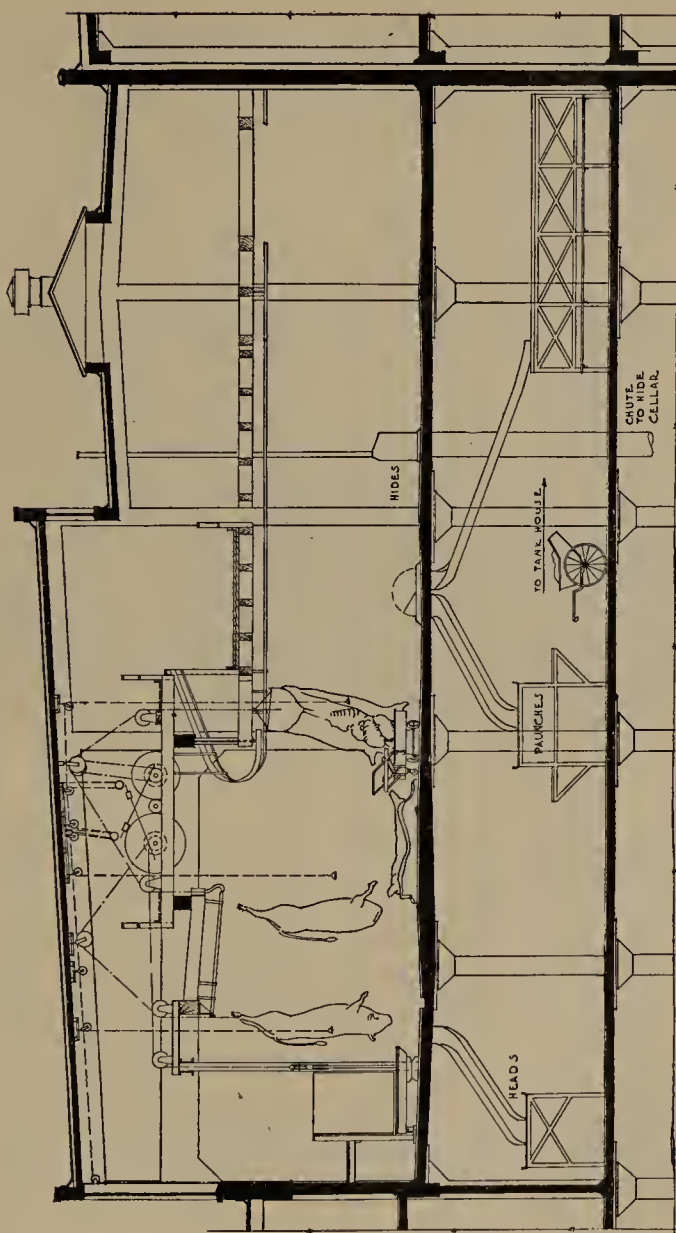
The small margin-of-profit factor crept into the industry very early. The smallest possible economies were practiced by its founders, not only in personal matters, but also in their business, and they always



Dressing cattle on endless chain conveyor

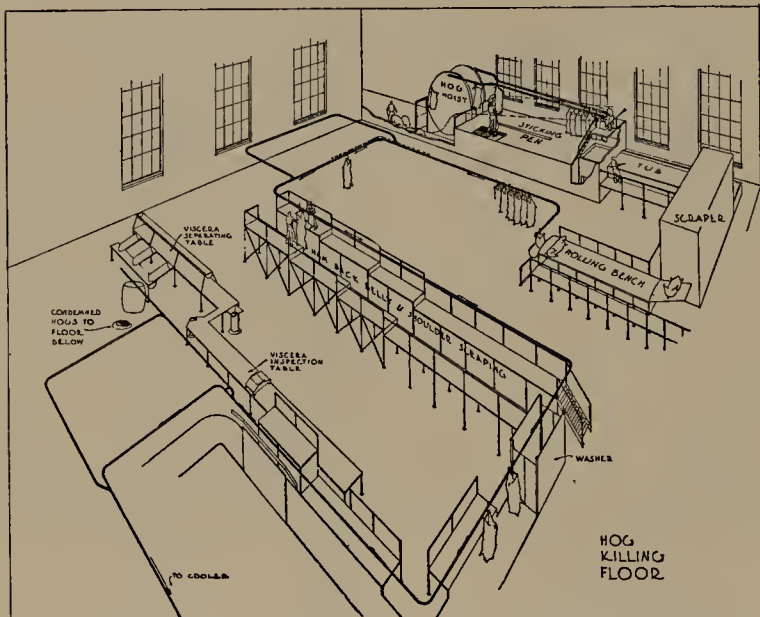
gave serious thought to the execution of work in their plants at the lowest possible cost.

Formerly, the butcher was expected to perform almost every occupation in the packing plant, from the driving of live stock to slaughter to the shipping of the finished product. Few could perform many different jobs with speed and accuracy, so that speed was limited and workmanship irregular. For economical reasons, it was seen that expert workmanship



Typical elevation of beef-killing floors (bed type)

was essential, and men were encouraged to become proficient in one operation. This constituted a very early step toward the specialization of labor in industry.



Typical hog-killing floor, indicating progress of carcass during the dressing operation.

At the beginning of this period, carcasses in the process of dressing were pushed along on rails from one operative to the next, by hand. Speed was uncontrolled, and production out of balance. An endless chain afterward was installed to move the carcasses by power around the killing floor and into the coolers, positively fixing the speed of production.

This probably was the first attempt in industry to control by power the flow of raw product during a manufacturing process.

Rapid fluctuations in volume make necessary the most careful planning. A large killing one day followed by a small killing the next throws labor costs

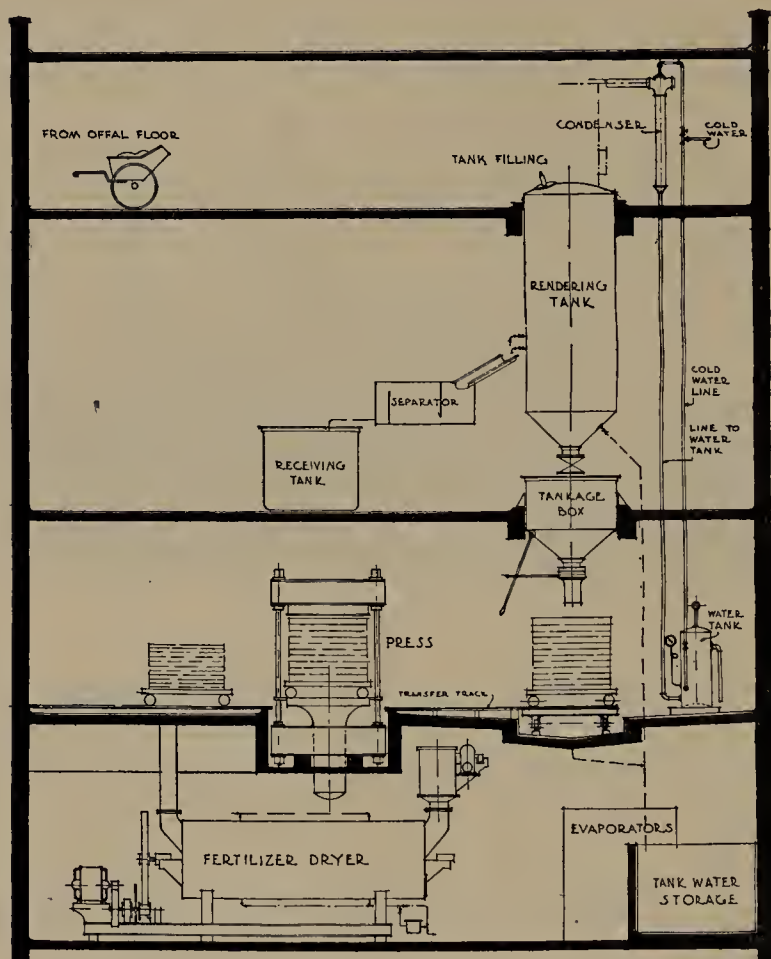


A modern packing plant

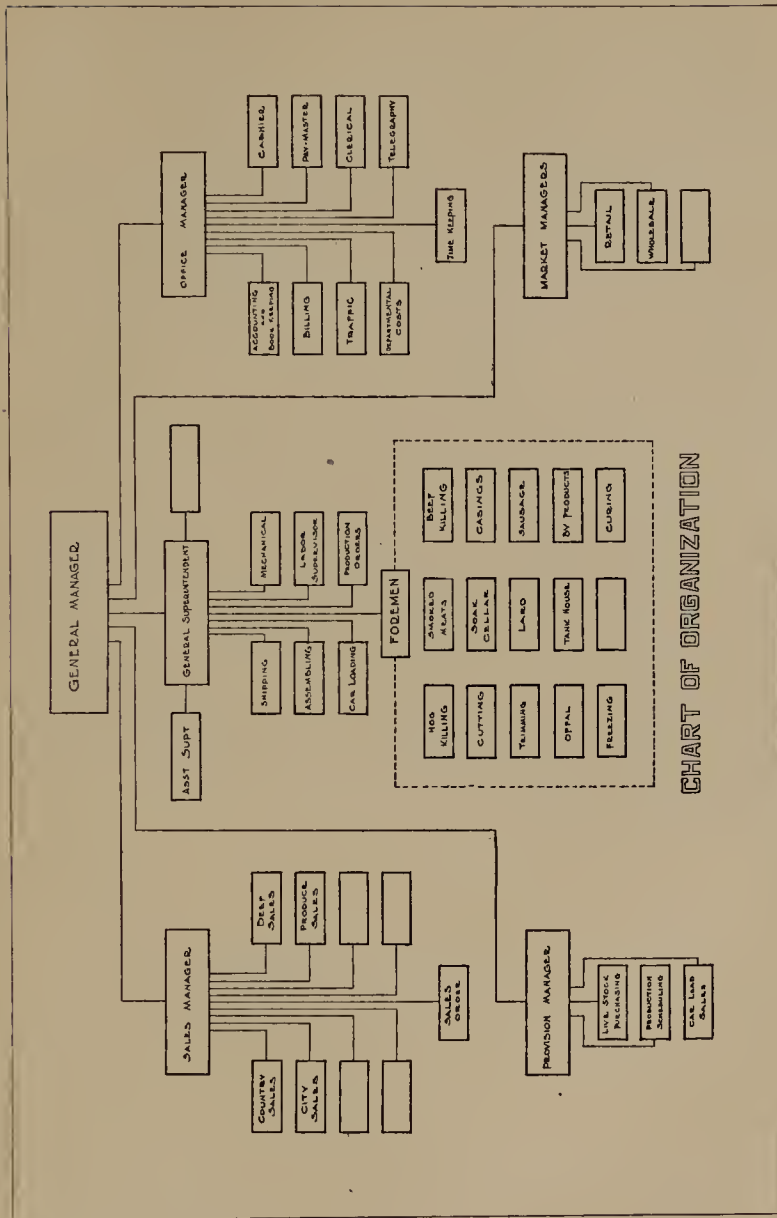
out of balance unless the manufacturing program is properly laid out. Consequently, the scheduling of production in the packing plant today is given first-hand consideration by the superintendent and assistants.

New buildings or additions to old ones are almost invariably built of brick and concrete, so to be as sanitary and durable as possible. The architect, in addition to designing columns, girders, and floors,

has added an artistic touch to the treatment of exteriors, which formerly received little thought. In new plants—and a number have been built during



Typical tank-house layout, emphasizing use made of force of gravity in conveying products from one floor to another.



Typical organization chart of a packing plant

the past few years—one finds the true expression of modern packing-house practice, as developed by the packing-house engineers: a plant in which the flow of product is always toward the shipping exit.

Beginning with the introduction of mechanical refrigeration, one finds an ever increasing tendency toward the standardization of equipment and practices in the packing-house. The revision of rules governing the sales of provisions on the Board of Trade gave more complete definition to the various cuts of meat which had been previously trimmed almost to suit the fancy of the individual packer. In 1906 the Bureau of Animal Industry of the United States Department of Agriculture established standards of buildings, equipment, and sanitation in plants operating under its inspection. These standards, which are being constantly revised, combine to make the plants and equipment of the packing industry perhaps the most uniformly standardized of any industry in America.



VICTOR H. MUNNECKE

Lecture IV

OPERATIONS: BEEF, LAMB, AND BY-PRODUCTS

BY

VICTOR H. MUNNECKE



OPERATIONS: BEEF, LAMB, AND BY-PRODUCTS

As I have attended these lectures and as I sat on the platform this evening and looked into the faces of this audience, the thought that came to my mind was that here was a group of men engaged in the great packing industry that were met on a different basis than any time in the history of the business. I have seen men here, some of whom I have known for a score of years, others important in the business whom I am privileged to call by their first names, and a great many, including these classes already mentioned, for whose wisdom and judgment I have the most profound respect. Also have I seen students of this great University over here on the Midway, sitting in the same classroom with the students from that other great university over there in what we affectionately call "the square mile," and I have asked and answered to myself the question as to what brings these men to these lectures. If my deductions are correct, the thing that brings them out is the same thing that has brought me out and that has prompted me to contribute in a small way to this program, and that is, because all of us are intensely interested in the subject and we are searching for something to make this business of ours a

better business, for ourselves and for future generations.

I think the Institute is to be congratulated on this educational program, and that the committee in charge of this work is to be especially commended for its efforts; and I hope that when some of you, my friends, are drafted you will answer the call and do your bit toward furnishing the public with information pertaining to your end of the business that may be helpful in maintaining our industry on the legitimate basis that it is entitled to hold in the world's merchandising scheme.

My subject this evening is: "Operations: Beef, Lamb, and By-Products."

Roughly, the beef and lamb business may be divided into three great fields: production, processing, and merchandising. As Secretary Wallace showed in the inaugural lecture, the raw materials of the packing business are the finished products of the farm. The fact that they *are* finished products, however, does not mean that they are similar or that they have uniform values for us. Each herd or flock, each section of the country, and each season of the year develop characteristics as greatly divergent as can well be imagined, when one considers the immense variation in animals such as exists between the cutter cow and the prime Christmas steer, or between the bucky, untrimmed lambs found in our eastern and southern markets and the uniform, well-finished

animals sent in from the range in the early fall trade.

PRODUCTION

The production of beef and lamb has been essentially a frontier occupation. The early settlers of New England and Virginia crossed the mountain ranges that barred them from the West in search of further grazing ground for their flocks and herds. In fact, the westward progress of the human race from its cradle in Asia has depended almost entirely on the search for less crowded pasture for its animal companions. The historian finds in the growing meat shortage of Europe at the close of the fifteenth century as potent a factor in forcing the discovery of the New World, as the political student finds in the desire for broader human rights and democratic government, or as the romanticist finds in the spirit of adventure of the soldiers and mariners of that day.

In the production of the nation's beef, certain sections of the country have developed as breeding grounds, others as maturing grounds, and still others as finishing grounds. The routine of production for thousands of cattle that reach the market annually is: to spend the first season from birth till well after weaning in the so-called breeding or calving grounds of the southwest range, to be transferred the following spring to the maturing pastures of the northwest range, and to be transferred again the following autumn or a subsequent autumn to the feedlots of the cornbelt.

The second great source of beef is the small herds operated throughout the higher-priced farming sections of the country that use cattle as one of their crops in a diversified system of farming.

The third great source of beef is in the by-products of the dairy herds, either in the calves unsuited for breeding purposes that come to the market as veal, or in the dairy cows and bulls marketed as meat.

The characteristics of cattle that come to the market at different seasons of the year, therefore, vary, depending upon the routine of crop production and consumption typical of the different geographic sections.

Using the cornbelt markets as an example, we find that the month of January develops runs of short-fed cattle which are not fully ripened from the standpoint of ideal beef but have been purchased as fleshy feeders to consume some certain crop or crop residue on the farm before the severity of winter requires the feeder to provide adequate shelter. In February, some of the better fed cattle begin to appear, and March, April, and May produce plenty of well-finished beef. By June the feedlots are nearly empty, since the average farmer must then devote himself to the raising of crops and feels that he can not spare the time for further feeding operations. In July, the cattle that have been grass-fattened on the southwest range or in the Kansas and Oklahoma pastures, begin to appear, and the first of the native yearling beef, calves of the second spring preceding,

commence their market run. This condition continues until the middle of August, when the grass cattle of the Southwest begin to be replaced by the range cattle of the Northwest. Although a few of the range cattle appear on the market about the middle of August, the true range run does not begin until the first of September and closes about the end of November. During this time there also come on the market large numbers of dairy cows which will not prove profitable to carry through the winter, numbers of steers that have been fattened on pasture in the cornbelt, numbers of short-fed animals that have merely been warmed up in the feedlots by cattlemen possessing a speculative frame of mind, and the general cleanup of herds that will not prove profitable to winter. December is the month for the marketing of holiday beef. The fall shows terminate in the International Live Stock Exposition at Chicago and the great majority of the show steers that have been on the fall circuit, or that have been finished for carlot exhibits at Kansas City, Toronto, and Chicago are available for slaughter. Although the quality of beef on the general market at this time is not as high as in some other months, owing to the hangovers of short-fed animals drawn from the range runs, the general effect is much similar, exclusive of show cattle, to that of January.

Lamb production has certain paralleling features. The United States is a lamb, and not a mutton, con-

suming country, and in general the marketable crop of the sheep industry is, therefore, the production of one season only. Lambs which still carry the milk flesh are marketed from April to September, the first lambs of the season coming from California, followed by those from the eastern and south central states, the middle west crop next, and the lambs from the range states coming in August and September. At the same time these range lambs are shipped for slaughter, large numbers are marketed that are too thin for immediate slaughter and these go into the feedlots of Colorado, Nebraska, and the other corn-belt states, and find their way to market from November to May, depending on their condition when they entered the feedlot and the time required for finishing. Aged sheep from the range are marketed principally in the last half of the year, but marketings from the native districts are fairly evenly distributed throughout the year.

The marketing of veal also is seasonal. The veal trade is based on two general classes of calves: the milk veals which come from the dairy districts, and the heavy veals which come from the southwest range or from the cornbelt in the fall. During the period from January 1 to June 1, from 80 to 90 per cent of the calves received are true milk veals, but from June on the percentage of heavy calves begins to increase so that in late September, October, and early November there are large receipts of heavy, common calves.

PROCESSING

The first problem the producer faces is that of transportation to market. The average beef cattleman is about 1,100 miles distant from the principal consumers of his product, and the average sheep producer is more than 1,500 miles from his greatest consuming market. Experience has shown that the cheapest method of transporting this live stock is to have it slaughtered somewhere en route at large markets where the total number of animals received will permit the preparation of assortments of different kinds of meat and meat products for the consumptive trade. As a result, it has developed that the cattleman ships his animals nearly 700 miles, on an average, while the packer ships the carcasses, on an average, from 400 to 500 miles additionally. Similarly, the sheep producer ships his animals nearly 900 miles and the packer continues the carcass another 600. From these figures it will be seen that an efficient and cheap transportation service is a highly important factor to both producer and packer.

When the producer's live stock is received at the public markets, it is taken charge of by the stock yards company, which is responsible for the animals until they are claimed by the producer or his agent, the commission firm, to which they are usually consigned. If, as sometimes happens, live stock reaches the market without consignment, the stock yards company places it in the care of a reliable commission

firm to sell. This commission firm attends to the feeding and watering and disposes of it at full market value, holding the returns until ownership is established. At the time the animals are unloaded they receive their first inspection by government veterinarians. This inspection is a general one to sort out all animals suspected of dangerous diseases. These animals are either labeled so that special inspection will be given them at time of slaughter or else they are slaughtered and destroyed in the yards without further examination. Range cattle also are inspected for brands at this time by brand inspectors maintained by the different range states, in order that the validity of the shipper's title to his cattle may be determined.

Live stock is sold to the packer on a basis of so much per hundred pounds rather than so much per head. Buying and selling is done in a very informal fashion. For example, a packer buyer will ride up to a commission salesman and ask what animals he has of a certain grade for which the buyer has orders from his house. If the live stock offered and the prices are satisfactory, the deal is closed by the buyer giving his order as to how to weigh them, but no payment is made or contract drawn up to bind the bargain. A simple method of trading of this nature frequently involves whole trainloads of cattle running into many thousands of dollars; for example, the company which I represent purchased during the war one trainload of

cattle for the sum of \$163,000. But such a thing as either buyer or seller refusing to carry out his bargain is practically unknown on live stock markets.

There are hundreds of buyers of live stock on all the large markets. When the supply of various classes of stock is light, these buyers vie with one another. Competition is always keen, but if the market is flooded with more animals than the trade can absorb to advantage, then the price is bound to decline.

After live stock is sold, it is weighed by the stock yards company and the amount paid by the packer is determined on the basis of these weights. On markets where clearing houses are maintained, commission men send their bills to the clearing house and buyers send their checks in payment to the same place, thereby saving both time and trouble. In order to expedite the return of money to the country on the same day that the sale is made, packers frequently do not wait for the making out of a bill but stamp the scales ticket, making the amount called for on the ticket payable at the packer's bank. Such scales tickets are cashed or deposited at the banks in the same manner as checks.

The price paid the producer reflects directly what the consumer, through the retailer, is willing to pay and still keep the market for fresh meat cleaned up. It is absolutely essential that every packer translate this demand directly, else he soon will lose his position

in the selling trade and will not be able to buy more cattle. A grave responsibility, therefore, rests upon the packer buyer. The principal measure of the efficiency of the buyer lies in his ability to estimate the dressing percentage of his "buy" and to recognize in the live animal the type that will produce a carcass meeting his needs. After years of experience the best buyers become exceptionally accurate and in terms of a year's purchases will not miss the dressing percentage of their total buy as much as one-half of 1 per cent. On daily purchases they will sometimes miss as much as 1 to 3 per cent on individual loads. Such a case as the latter is extreme, however, and many mistakes of this sort reduce a buyer's efficiency to less than zero.

In the big packing houses, each buyer is provided in the morning with a record of the cattle he bought the day before. In this record he usually receives information as to the average live weight of the cattle, the average dressed weight, the average per cent of internal fat, the live cost of the cattle and the flat cost of the beef after slaughter, based on dressing percentage but including the average credits for hides and by-products, and the debit for killing costs and general overhead. This flat cost does not correspond with the selling price. It does not include freight to distributing points or selling cost. It deals with the animal at its own point of slaughter. Sheep, lamb, and calf buyers receive corresponding information.

The live price of animals and the prices of their products bear very definite relationships to each other. In the long run, the prices the packer receives from his customers for meat and by-products determine the prices which he is able to pay for live stock. In this connection, of course, the supply of live stock as well as the demand for meat and by-products is a determining factor.

As has been stated previously, not all live stock coming on the market has the same value, and a system of classification and grading has been adopted that in general has proved satisfactory. No official grades of live stock have been fixed, but custom, as molded by the needs of the trade, has established certain standards that are well understood by everyone on the market. No attempt will be made to show the market classes of all kinds of cattle and sheep but only suitable illustrations will be drawn to present the system. Cattle are classified according to quality and weight and they are graded according to their merit in fulfilling these purposes. The two major classes in the beef trade are beef cattle and cutters. Beef cattle produce carcasses suitable for the wholesale and retail trade while cutters are used for various plant purposes such as market cuts and sausage material. Beef cattle are graded as prime, choice, good, medium, fair, and plain.

The best type of beef steer should be straight in top line and underline; deep-bodied, short-legged, and

symmetrical in all parts. It should possess a smooth, meaty appearance, carry thick cuts in the *valuable parts*, such as the loins and ribs, and be proportionate between the carcass and internal organs. The buyer of fat cattle must not only determine what kind of carcass the animal he buys will produce, but he must determine what the steer will yield in terms of carcass to live weight, the dressing percentage already referred to. Fat steers always outdress those of less finish. The average run of steers dress out around 55 to 57 per cent, depending on the season. Good to choice animals range from 58 to 60 per cent, and extra good show animals dress from 60 to 63 per cent. Fat cows and heifers average about 51 to 56 per cent, and cutters and inferior stock from 38 to 51 per cent. The champion steer at the last International dressed out 68.6 per cent, although a very young animal.

One source of loss for both the producer and packer in the handling of cattle is shrinkage in weight. For example, cornbelt beef producers find that their cattle shrink from 40 to 60 pounds per head during shipment from the home feedlot to the market. This loss, of course, is not in the actual carcass or by-products of the animal but is entirely from the intestinal contents and water. The average loss resulting from the transportation of cattle from the time they leave their feeding grounds until they reach the market amounts to from 4 to 9 per cent of their live weight. For humane reasons and in order to improve their killing

condition, cattle on reaching the market are fed and watered. At slaughter, the contents of the stomach and intestines represent approximately 16.3 per cent of the live weight. This question of fill is claimed as a right by the shipper, but since there is no addition made to the carcass, it has been questioned by many authorities as an economic waste. Certainly, undigested corn and other feed that the packer must wash into the sewers is nothing but loss.

The operations of slaughter will be briefly illustrated for cattle only, although the general principles apply to sheep and calves as well. After the cattle are weighed by the yards company, they are moved to the packer's holding pens from which they are driven up a chute or incline to the killing beds, which, in most cases, are on the top floor of the plant. Here they pass into a line of knocking pens and are stunned by a blow from a sledge hammer. They are hoisted by the hind legs for sticking, the blood being caught for use in the manufacture of meat food and by-products. The slaughter of animals for the kosher trade is conducted in accordance with the Mosaic Law.

After the animals have bled thoroughly, the heads are skinned out, washed, and prepared for the government inspector. The carcass of each individual animal holds its place in rotation throughout the entire dressing operation, all parts cut from it being kept in the same order until all government inspections are finally completed. After the heads have

been removed, the cattle are dropped from the sticking rail to the floor with the feet in the air. The fore and hind legs are detached at the knee joints and sent down a chute to be processed into various by-products such as glue, bonemeal, selected bone, etc. The hide is opened down the center of the belly and skinned off the sides. The cattle are then hooked through the hocks and partly raised from the floor, the middles opened, the entrails removed, placed in a sterilized moving pan, and inspected. While this is going on, other men skin out the rump and pull the hide free from the round. The tails are skinned out and the carcass is then raised completely. The hide is removed from the back and the hide-droppers follow to remove the skin entirely from the legs and shoulders. The aitch bone is sawed and the carcass is split through the center of the back bone as far down as the neck, by means of long cleavers. The split carcass passes on a moving trolley, is thoroughly scrubbed with warm water, wiped dry, and sent to the last government inspector. If no disease has been found in any part of the animal, it is stamped "U.S. Inspected and Passed" and sent to the coolers. That is the procedure in plants doing an interstate business. From twenty-four to thirty-six hours are required to chill the carcass and it is then held at a temperature of 54° to 36° F. In the larger plants the entire operation of slaughter, from knocking to final inspection, requires about one hour.

MERCHANDISING

Our country is so divided into localities or zones by reason of the time of settlement, the nationality of the settlers, and the development of tradition that beef and lamb must be marketed in different forms in each of these zones. In many sections the demand is a relic of the days when the English populated New England, or when other nationalities introduced the customs of the meat trade in their homeland. As a result, many styles of quartering or ribbing beef and many more styles of preparing smaller cuts, such as ribs, loins, and rounds, are in vogue today. Each section calls for a different class of beef or lamb, and the distributor will not get the last nickel out of his product unless he guides his operations accordingly. As already has been stated, beef or lamb, unlike the raw material of other industries, varies even though the animals may come from the same herd or flock and be fed the same ration. Therefore, the business of selling beef and lamb is largely one of representation, and sales are based on the way the product is pictured in the mind and eye of the prospective buyer.

Fundamentally, our business is to keep the flow of meats free from the point of origin of the live stock in the West to the points of consumption in the East, thereby preventing famines and consequent economic and social loss. The day is long past when anyone can "scoop" or corner the live stock market. I question whether the "scoops" of the olden days ever

resulted in ultimate profit to the operator, because the temptation to overbuy must nearly always have led to loss. In my own experience I have seen such attempts result in great loss rather than profit by reason of the consequent oversupply.

The first essential in keeping the meat channels open is intimate contact between the selling trade and the packer buyers. Hourly touch is absolutely necessary with all sections, and the purchase of cattle and lambs, both as to amount and kind, must directly reflect the selling reports. As a result, all packers conducting a national business maintain leased wires which give direct contact at all times between the centers of consumption and the live stock markets.

The first step in the successful merchandising of beef and lamb is careful and accurate classification and grading. Thus, for example, carcass beef is divided into four classes—steers, heifers, cows and bulls, and stags—and within each of these classes grades of prime, choice, good, medium, fair, and plain are established. In addition to the above classes, carcass beef may further be designated as native and western. Native carcasses are nearly all produced from grain-fed animals, while western carcasses come from grass-fed animals. Native carcasses, therefore, differ from westerns principally in shape, finish, color and texture, thickness, and age. They are fatter and firmer in flesh, because of their grain feeding, more compact in form, thicker fleshed in loins, ribs, round

and chucks, brighter in color of flesh, whiter in color of fat, and show less age in proportion to size and better marbling and superior quality throughout. Westerns, on the other hand, are cattle shipped off the range which have had no grain, are loose-coupled in form, have coarser-grained flesh, larger and harder bones, with more age in proportion to weight, and darker color in both meat and fat. The carcass is generally less firm, is more likely to be bruised, and does not hold up as well in the trade as the grain-fed carcasses.

In addition to being graded for quality, carcasses are graded by weight and sex. About 14 per cent of all cattle marketed are cutter and canner cows, while about 40 per cent of the cattle suitable for carcass beef are she stock. In steer beef about 40 per cent of the carcasses run over 600 pounds and about 60 per cent under. The demand for the heavier carcasses varies little throughout the year. The markets of the big cities supply the principal trade for them, the sales being largely to hotels, restaurants, dining cars, and clubs that have a standard demand for certain cuts the year round. This natural demand for heavy carcasses takes only about 15 per cent of all the shipper cattle on the market, their live weight being 1300 pounds and up and their dressed weight 700 pounds and up. It is difficult to obtain this class of cattle at all seasons of the year, as very few of them come to market between August 1

and February 1, except those finished for shows and the Christmas trade. From February forward, however, there is usually a sufficiency of this class of cattle, while in late March or April the market may be overcrowded, with a consequent drop in price. On the other hand, in times of scarcity of heavy cattle, buyers having orders for this class of stock make competition so lively that they often bring one to two dollars per hundredweight above their real value as compared with smaller animals of the same grade.

Very few cars of cattle as bought on the hoof can be sold straight. Most cars of dressed meat must be made up of assorted lots, based on quality, weights, cost, and suitability to the general trade of the region in which the carcasses are to be marketed. Usually four or five choice carcasses, five to eight medium, five to eight fair to medium, and two to five plain make up an assortment for refrigerator car shipments. Several reasons exist for this diversity. Practically no branch house or wholesale meat jobber handles one class of trade only. Nearly all are located in towns or districts where their customers consist of hotels, restaurants, shops retailing to the best family trade, and shops retailing to the average family trade. As a result, each must keep a stock of beef on hand to please these diversified tastes and the supply of this stock through refrigerator cars reflects this condition.

The trade in kosher beef is a feature of considerable importance to the beef industry as a whole,

since it provides a source of meat supply for orthodox Hebrews as well as a helpful outlet for the forequarter which is not so popular as the hindquarter at the general run of markets. In New York, this trade takes a big percentage of the best heavy cattle and of the light choice cattle. The greatest percentage of these cattle are steers, although some fat cows and heifers are included. In Chicago, the kosher trade furnishes the best outlet for chucks, plates, and briskets from heavy steers and from various grades of cows, as well as a few fed bulls and bolognas.

One interesting factor in the modern beef trade is found in the gradually growing demand for fed beef. It is becoming increasingly difficult to market grass fed or unfinished beef, the distinction between this season's market and that of even a year ago being quite marked. Consumers are willing to pay several dollars per hundredweight more for the carcasses from finished animals than for those from grass. For example, during the past season native beef carcasses sold freely in New York at satisfactory prices while good grass beef was dragging on the market with wholesale prices five to eight cents a pound lower.

The greatest quantity of beef is marketed in the fresh form, although nearly 10 per cent by weight is sold in a semi-permanent form as frozen beef, cured beef, or canned beef. Roughly speaking, about 3 per cent is frozen, an additional 3 per cent is cured, and about 4 per cent is canned. The American people as

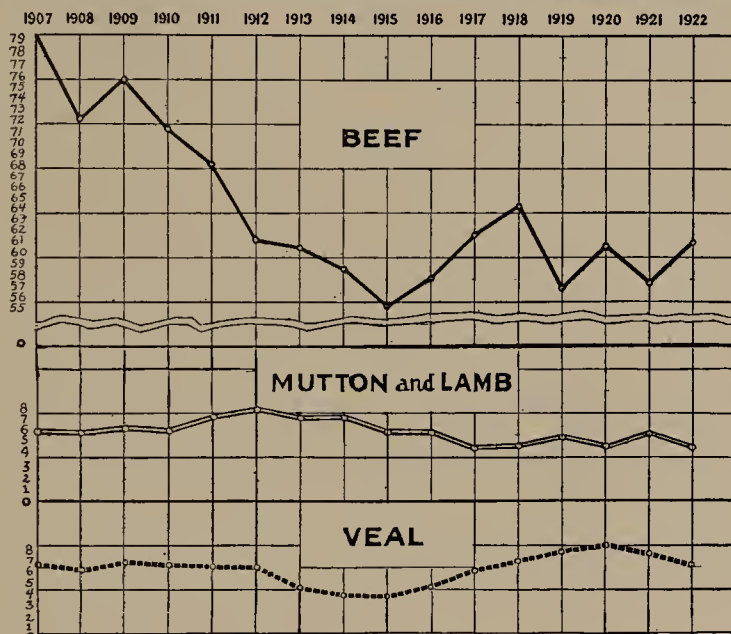
a whole will not buy frozen beef or mutton and much of the meat that is frozen is put in that form temporarily for later manufacture into sausage. However, certain cuts, such as tenderloins and strip loins, are frozen for sale to the hotel and restaurant trade, as are the loins and ribs of prime cattle whenever they come on the market in surplus amounts. Boneless chucks and beef trimmings are frozen for sausage manufacture. The live stock for the preparation of cured and canned beef, of course, is drawn from the cutter and plainer grades on the market, since meat free of fat is required for this purpose. Usually she-stock, dairy and plain cows, and occasional thin steers of inferior breeding that would seem to be definitely unprofitable in the feedlot are used for canned meat production.

VEAL

The most valuable by-product of the dairy industry from the standpoint of unit value is the production of the veal calf. Certain regions of the United States are extremely important as veal consumers, despite the fact that a few years ago veal was not a staple but was sold by the local farmer as a specialty, either to the corner store or to the housewife direct. Veal was then a product for the Sunday dinner, just as fish has developed as Friday's specialty. However, the modern centralized market, modern inspection, and sanitary rules drawn up governing the merchandizing of veal in the village and the small town as well as

in the larger cities, have driven the calf to the central markets; and the production and merchandising of veal is therefore a function of the packer, the same as the production and merchandising of beef and pork.

ANNUAL PER CAPITA CONSUMPTION OF BEEF LAMB AND VEAL 1907-1922



The industrial districts in which large foreign settlements are located usually provide the best veal markets. For example, the Jews and the Slavic races, especially the Poles, consume relatively large quantities of veal. The average veal consumption per capita fluctuates considerably, owing in part to the fact that it is based on a shortage of production. In other words, the United States exports no veal,

but since 1914 has imported appreciable quantities. In 1907 the average veal consumption was about 7.1 pounds per capita, dropping through gradual degrees to 4.3 pounds in 1915 and thence upward to 8.9 pounds in 1920 and back again in 1922 to 7.3 pounds.

LAMB

Lamb consumption is also a sectional proposition. A few years ago the Department of Agriculture showed that the average consumption of lamb in the cities of the North Atlantic region of the United States was 10.9 pounds per capita annually, whereas in the rural districts of the west North Central section it was as low as 3.8 pounds. With the single exception of the range states, urban consumption always exceeds rural consumption by 1 to $3\frac{1}{2}$ pounds annually, while the rate of consumption per capita annually is almost in direct ratio to the density of population. Just at present, lamb consumption in the United States is limited by production, but the class of trade that demands lamb will not permit such a condition to continue indefinitely, despite the protection of the new tariff, unless American producers adequately meet their demand. A 10 to 15 per cent increase in the number of lambs marketed over those of this year could be absorbed by the American market without important reductions in price levels.

The fundamental fact in merchandising the products of the flock is that the demand is for lamb

rather than mutton. Over a period of twenty years, lambs have outsold yearlings on foot by an average of a dollar and a half to two dollars per hundredweight, and sheep by a much wider margin, with the spread constantly widening. The difference on carcasses is even broader. Discrimination for quality has become increasingly strong within the groups of lambs themselves. Carcasses are divided into lambs, yearlings, wethers, ewes, stags, and bucks. Division is made in the live animals between westerns and natives but in the carcass trade they are graded according to quality and weight regardless of origin. Prime and choice lamb carcasses weigh from 28 to 42 pounds during the milk lamb season, and up to 45 pounds during the rest of the year. The maximum weight for desirable lamb carcasses is 50 pounds and lambs weighing over this are seriously penalized, owing to the facts that the chops are too large, the legs and shoulders are too heavy for the family trade, and the carcass buyer is likely to suspect them of being mutton because of their size alone.

Merchandising of meat is very often interfered with by well-meaning people in the densely populated sections who sometimes have an inadequate conception of the economics of live stock production. For example, a group of well-meaning women in a large eastern city some four or five years ago "launched" an eat-no-lamb campaign, arguing that if the lambs were allowed to grow into a mature

sheep the production of meat or mutton in this country would be correspondingly increased. These people did not know or realize that this would be an economic waste. In the first place, the amount of lamb or mutton produced in any year is not determined by the number of head or the age of animals so much as by the amount of feed that has been available for their development. If wether lambs were held over until maturity they would displace just so many breeding ewes and the net result in pounds of meat and wool would actually be less because the lamb crop would be more limited. In the second place, the ranchman could not afford to hold his crop of lambs until they matured into sheep, since the market value per hundredweight would be cut in half, owing to lack of demand for mutton as compared with lamb.

Some years ago, a national law was proposed to prohibit the slaughter of veal, on the ground that if these calves were allowed to mature into beeves, the beef supply would be so increased and the price so cheapened that every consumer could afford to eat all the beef he wanted. The people behind this movement did not realize that every calf killed for veal is an animal that would prove unprofitable to the producer to carry on. In the case of calves from dairy animals, most dairymen would rather destroy them at birth than be forced to put expensive feed into them unless he is allowed to sell

them as veal; while in the case of the heavy veals marketed in the fall, the prospects are that the cost of wintering over for sale the following season as feeders is much greater than the increased value of the animal due to its growth. As a result, in either case, such a law would have resulted in economic loss.

The cattle, sheep, and calf business presents quite a problem to the packer from a cost standpoint and is a good example of operations producing major products and by-products.

The major product is the carcass, and the by-products necessarily produced in the same operation that produces the major product, are hides, pelts, fats, fertilizer, livers, hearts, tongues, etc.

The packer knowing the cost of live animals plus operating expenses is in the same position you would be if asked to *disassemble* an automobile valued at \$1,000 and to place a cost price on each of the many intricate parts, balancing out the aggregate value to the original price of \$1,000. He, therefore, follows the only practical procedure, which is to credit the total cost of the live animal plus operating expenses with what he feels is the present day market value of the by-products—for example, if the live cost of a 1,000 pound steer is \$100 and the operating costs and expenses were \$5, the total cost is \$105; if, in his opinion, the by-products would have a net worth to him of \$15, the carcass beef will cost \$90 for the

500 pounds of dressed weight, or an average of 18 cents per pound.

The determining of costs, however, is not so simple as this illustration would make it seem. The live cost is, of course, readily obtained and the average cost of slaughtering and dressing can be computed, but the by-products values are affected by many things. For example, hide values are based on the market for cured hides, fat values on the market for oleo oil, stearine, tallow, grease and tankage, and so on. In making these valuations on the green by-products, shrink in hides, yield of oil, yield of fertilizer ingredients, etc., must be taken into account as well as the operating expense of these departments and the changes in the by-products markets from week to week and often from day to day must also be considered. Furthermore, the by-products from the various grades of animals will vary greatly, and a knowledge of them can be ascertained only by tests made of representative lots.

Cattle and sheep are purchased in lots and the lots are usually killed out separately and the costs computed for each. While the cost of dressed meat is calculated from day to day, this cost as finally computed may be slightly different, because the expense of killing is a variable element, due principally to the changes in the numbers of animals slaughtered. Furthermore, by-products values that are used in making daily computations of cost are

likely to change considerably by the time these raw products have been made into manufactured articles ready for sale.

The slaughterer must always be fully informed as to the value of his by-products as well as the dressed carcass. The severity of competition in the selling of meats and the ever-present probability of spoilage means, in my opinion, either that beef can not long stand on a high valuation, or live stock at low levels, if by-products warrant a reduced price for meat or a higher price for live stock.^{*} For example, no one can sell beef on a basis of 90 to 95 per cent of the total income from the animal when the by-product values are great enough to allow competitors to sell on a basis of 80 to 85 per cent. If the first prices for beef are maintained, the packer so doing would find his beef trade in the hands of his competitors almost over night. Artificial supports can not be introduced into the beef business or the by-product business without a serious reaction in loss of trade and an unstabilization of values which would be felt both in the beef and live markets.

The same condition applies to sheep and lambs as to beef, except that the relation of the pelt to total credits is subjected to greater variation than is the hide. Immediately after shearing sheep pelts are nothing but slats, worth about fifteen cents, but the same skin with the wool on may be worth \$2 to \$3.

^{*} This topic is also discussed in Lecture II, "The Packing Industry, Its History and General Economics," by L. H. D. Weld—Editor.

This amount, minus the slat's value, materially affects the cost of the dressed products when pro-rated against the 35 to 50 pounds of meat. Pelts, therefore, affect the cost of dressed lamb to a much greater extent than hides affect the cost of dressed beef, since in the first case pelts comprise about 15 per cent of the total credits, while in the case of hides they comprise only $5\frac{1}{2}$ to 7 per cent.

BY-PRODUCTS

Much has been said in the past regarding by-products, and each class of by-products provides almost a special industry in itself when manufacture is considered. It, therefore, is impossible within the scope of this paper to treat with each of the by-products definitely, but for illustrative purposes the manufacture of oleo oil from fat will be considered.

Next to hides, the second most valuable by-product from the steer is the fat which in the average run of cattle is about 45 pounds per head. The sources of this fat are the caul, the ruffle, and certain kindred fats with perhaps a small portion of heart fat and tripe fat. This fat is taken directly from the carcass when it is warm and is passed through a slicing machine, which cuts it into ribbons an inch an a half or two inches wide. It is then chilled in clear water until the animal heat is thoroughly removed, after which it is ground and conveyed to the melting kettles. When it is thoroughly melted, it is allowed to settle and the melted beef fat, or what is now known as oleo

stock, is siphoned off into clarifying tanks. After clarification, the oil stock is drawn off either into seeding trucks or seeding machines, the seeding or crystallization being carried on for the purpose of separating the fat with a high melting point from the fats of a low melting point. This crystallization requires from 22 to 72 hours, depending on whether the seeding is done in machines or in trucks. After the seeding is completed, the stock is mixed and sent to the presses, where it is placed, in units of about 8 pounds, in duck cloths between galvanized iron plates. When the presses are filled, pressure is applied very gently throughout the whole process so that the softer oils may be expelled and separated from the stearine, which has a much higher melting point. From the presses the oil gravitates to large storage tanks, so that the run may be uniform throughout, and it is then drawn off into tierces and placed in storage for use in the manufacture of oleomargarine, a process in which it constitutes up to 50 per cent of the materials employed. Oleo stearine, which is a by-product of the manufacture of oleo oil, is used in the manufacture of lard compound, stearic acid, glycerine, buffing compounds, cosmetics, in the tanning of hides, and in many other ways.

While by-products may be classified into edible and inedible products, this is not really a fundamental classification from the standpoint of source. The principal by-products may be listed as follows: hides

and pelts; bones, horns, and hoofs; wool, hair, and bristles; intestines; meat scrap and blood; glands and organs; fats and other edible by-products.

Many highly important medicines are manufactured from the glands of cattle and sheep, such as thyroid, used in the treatment of goiter; suprarenalin, a powerful heart stimulant; and pituitary extract, used by the medical profession in numerous ways. Surgical ligatures are manufactured from the intestines of sheep. Calves supply rennet, used principally in cheese making, but also contributing an important ingredient in the manufacture of pharmaceuticals. The most striking thing in the development of the by-product business is the great amount of research work that has been done to discover the most efficient utilization of the raw material, especially from cattle and lambs. This research work is still being conducted on a large scale and many further uses are suggested as time goes on.

EFFICIENCY IN BEEF AND LAMB INDUSTRY

The efficiency in the utilization of by-products is not the only spot at which efficiency has been developed and to which attention should be called but it is the only branch of the industry in which we will take up the discussion in detail at this time. As a matter of fact, the improvement in efficiency has been carried back very definitely to the breeding grounds, where the sharp competition of the industry and the narrow

margin on which it operates have stimulated the use of good blood in the herds and flocks, a more efficient economy in ranch operations, and more exact standards of care and feeding. At the same time, there has been a great improvement in the type of both cattle and sheep. There is no longer the waste in surplus fat and overfinish that was common fifty years ago, nor is there the waste of underfed and underfinished animals corresponding. The railroads have improved service in live stock shipments so that we have better cars and more rapid transit; the handling of live stock in the yards and the disposition and distribution of labor inside the packing-house have been standardized to a point resulting in minimum costs; the developing of icing facilities and refrigerator cars has permitted better distribution facilities and has almost entirely removed loss through spoilage or taint; and improved branch house equipment and management have contributed materially to better merchandising schemes. As a result, today, the meat goes into the hands of the retailer in better condition than he can slaughter on his own premises and deliver to himself. Beef and lamb can be delivered regularly in good condition six and eight days away from Chicago and other central markets.

The packer must be in the market all the time, every day in the week and every week in the year, and he must find a place for everything offered for sale. It is not so many years since live stock was shipped

to market in an absolutely indiscriminate manner. As a result, great gluts occurred with consequent low prices, followed by periods of scarcity with high prices. Neither of these conditions meant profit to the buyer or to the producer of cattle. At times of heavy runs, prices to the producer would necessarily be lowered, as the price level for dressed beef is depressed when the market is flooded; when the runs are light and there is not a sufficient supply to meet the demand, the price of live cattle is forced up. Under such a system of indiscriminate marketing, the price to the bulk of producers is lower, because only a relatively small number received the high price, and the general morale is therefore weakened.

During the periods of low prices, the packer or other buyer of cattle would be disposed to buy more than he needed; his coolers would become congested and he would always be required to sell for much less than he contemplated at the time of purchase. On the other hand, when a large number of animals were slaughtered and the killing gangs were working to capacity, the cost of slaughter per head was reduced, while during periods of shortage the number of animals was not sufficient to keep labor wholly employed and the costs began to mount immediately. Moreover, the general overhead of the business had to be distributed over fewer carcasses and thus provided an additional charge per pound of meat. These varying conditions still exist, but in a somewhat more limited

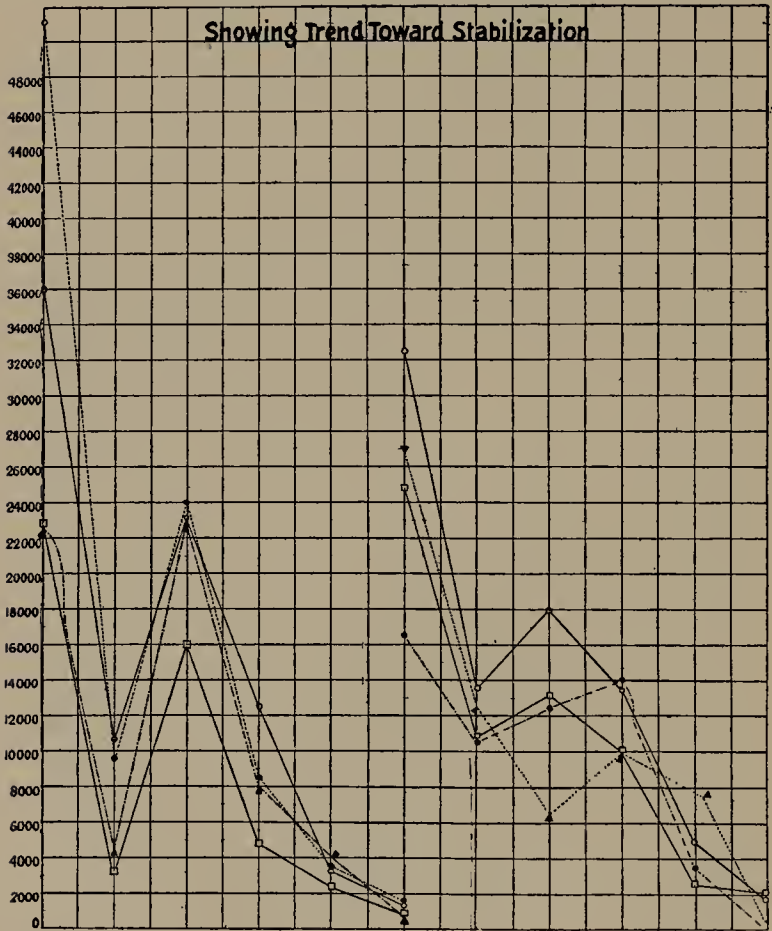
way. Producers, in general, now recognize the necessity, not only of a market stabilized in price but also stabilized in supply, and, through their organizations, are bending their attention to the problem of equalizing live-stock runs. Such stabilization is certainly beyond the reach of the packer.

Two types of remedies have been tried. The first is popularly called the five-day market, in which attempts are made to equalize the receipts over the week. While there are certain days when there are needs for heavier receipts, the lowering of the peaks of the Monday and Wednesday receipts and the raising of the low points of Tuesday and Thursday have aided materially in stabilizing the market. The second type of remedy was that of the zoning system, in which the time of shipment was based on the distance from market. With the co-operation of the railroads arrangements were made whereby shipments from the more distant zones were received during the first part of the week and those from adjacent zones were received during the last part of the week. This actually caused some improvement from a general standpoint, but led to considerable criticism among producers, since some felt that if they could have marketed on the day some other zone was marketing, they might have received better prices.

It thus will be seen that some persons in thickly congested sections of the country may know but little about the great problems of production; of the vast

numbers of cattle that come every year through the breeding, feeding, and finishing stations, of the con-

DAILY RECEIPTS OF CATTLE IN 4 REPRESENTATIVE WEEKS OF 1908 1922



stant nursing of immature cattle and the problems of meeting seasonal shortages in supplies, and of the

constant effort for economy in the intensified feeding of the people. On the other hand, some producers little appreciate the problems of distribution and selling meat. They believe that there must be great hordes of hungry people clamoring for beef and lamb and that the only problem of selling is to ship meat to their midst. They do not understand that for each class of food there is someone purveying a substitute, and that regardless of the lack of quality of the substitute, strong selling effort must be expended in order to overcome it.

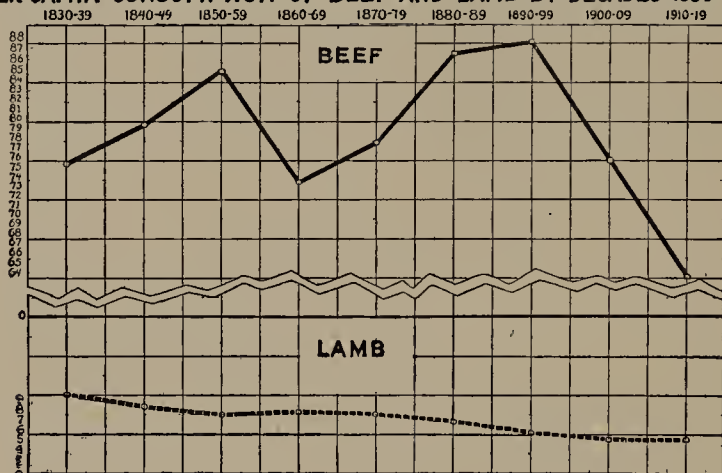
PER CAPITA CONSUMPTION

The annual per capita consumption of beef apparently decreased more than 20 pounds between 1907, the first year of Federal Meat Inspection, and the low period in 1915. Since 1915 the per capita consumption of beef has varied but has not approached the high years in the first part of the period under discussion. The consumption of lamb and veal has also varied, this variation being traceable almost directly to changes in supply.

Personally, I have never felt that the alarm over this apparent decrease in beef consumption was entirely warranted. True, there were doubtless the fluctuations that will always come as a result of industrial depression and industrial progress, but to my mind the actual amount of beef consumed per capita did not vary as much as our figures would

indicate. I base this assumption on the belief that much waste has been eliminated and that practically all the beef marketed by federally inspected plants in later years was consumed. In the first place, the cattle themselves more nearly produce cuts of the

PER CAPITA CONSUMPTION OF BEEF AND LAMB BY DECADES 1830-1919



The decrease in both beef and lamb consumption is doubtless due in large measure to better methods of measuring per capita consumption, to the production of less wasteful animals, the more efficient methods in the packing house and in distributive facilities, and to the more economical utilization of meat in the home.

size and quality demanded by the general trade, so that all of the meat purchased is utilized; in the second place, packing-house practice, modern refrigeration, improved refrigerator cars and improved branch house facilities have eliminated taint and spoilage, thus reducing waste; and lastly, the efforts in the direction

of more orderly marketing and the avoidance of the enormous gluts of cattle have contributed no small part to this economy.

Needless to say, it is with much pleasure that I have reviewed the government's recent report on meat consumption, particularly the increase in the per capita consumption of beef from 57.8 pounds in 1921 to 61.4 pounds in 1922. . With an approach toward normal in the industrial world, with the government and other agencies again advocating the use of more meat by indicating its desirable place in the diet, and with a growing realization on the part of those who were wont to substitute other foods that after all nothing would take the place of meat, the outlook for the cattle raiser and the packer is brighter indeed than it has been since the period of severe reverses following the close of the war.

THE FUTURE

In conclusion, I wish to enumerate briefly a few of the improvements we shall expect in the beef and lamb industry of the future. *First and foremost*, we shall expect to see a further stabilization in the runs of cattle and sheep at the central markets, and a consequent stabilization of prices. This will place the packing industry still more securely on a manufacturing basis and tend to further discourage such minor speculative elements as still remain in the handling of beef and lamb. *In the second place*, we may

expect to see a continued improvement in the type of cattle and sheep brought to market, with a further adaptation to the demands of the consumer and relatively lowered costs of production on the ranches and farms and in the packing industry. *In the third place*, we shall expect to see the scientific laboratories of the packing industry develop still further the profitable utilization of materials not now used of by-products at present incompletely marketed. *In the fourth place*, we may expect a better demand for live-stock products, due not only to the relatively increased cheapness at which they may be furnished, but also due to the concerted effort of such institutions as the Meat Councils, the National Live Stock and Meat Board, this Institute and others of promotional type mentioned previously in this series of lectures.

In my opening discussion, I referred to the fact that the reason underlying your attendance here tonight was your interest in the betterment of our industry so that it shall hold out a hope of livelihood and adequate reward to our sons who will succeed us. While new problems in the industry will always arise to take the place of the old ones, it seems to me that the outlook for progress in the industry which I have already discussed, warrants the belief that this condition will be attained, and that the packing industry will hold for years to come the same challenge to inventive genius, efficiency, and progress that it held for its founders.



OSCAR G. MAYER

Lecture V

PORK OPERATIONS

BY

OSCAR G. MAYER



PORK OPERATIONS

I am aware that in this discussion we are tackling a deep and difficult subject, which can be treated but very inadequately in the short time at our disposal. The situation brings to mind the statement recently made by Prohibition Director Haynes, to the effect that the violations of the Prohibition Law were contributing greatly, in a financial way, to the enforcement of that statute, whereupon the cynic added that now if we will only get enough violations we will have complete enforcement. My hope is that, in spite of my violations, the subject will at least be so touched upon as to stimulate further interest and inquiry on your part into what is unquestionably one of the most fascinating as well as most baffling businesses in the world today.

We are dedicating this lecture to that noble vertebrate, the hog—a most excellent fellow, not merely from a cold economic standpoint, but as a personality. Though calmly independent, he is always approachable; he does not curry favor; he is never forward; he lives and lets live. He is thrifty, but believes there is a time for rest and leisure. Democratic in his tastes and instincts, he would be a Liberal in politics. He accepts man as his friend and

equal, and unlike some higher species, who often show a prejudice against paying their debts, he believes in repaying with abundant interest the food which has been loaned him—truly a great and magnanimous fellow.

The hog has been associated with mankind since time out of mind. Definite records as early as 2900 B.C. show the domestication of the animal in China, and there is evidence in the record of the rocks to indicate that men had learned to domesticate swine as early as the stone age, ten or fifteen thousand years ago. From that beginning, when the first hog was dressed and men first appreciated his tastiness, until the present, great improvement in breeding has been effected, until we find our hogs today with legs shrunk almost to the vanishing point, and heads telescoped well back into their shoulders, a veritable barrel of fat and protein.

The up-to-date hog is by far the most economical food animal in existence. Cattle average, in the carcass and edible by-products, not more than 60 per cent of the weight of the live animal. Sheep and lambs average between 40 and 50 per cent. But the hog, with his unique economy, contributes from 80 to 85 per cent of every 100 pounds of his live weight to the upbuilding of man.

Pork is at the same time one of the most nutritious of all meats, containing a high admixture of fats. It has the further advantage that its flavor is not

impaired but improved by the salt-curing process, to which, on account of the size of its cuts, it is well adapted. This is why, in contrast to beef and mutton, from 35 to 40 per cent of the live hog finds its way into the curing cellars of the packing plants, giving rise to the packing business proper and its numerous problems.

Hogs fall into two main types—bacon and lard hogs. The bacon type is represented mainly in the Yorkshire and Tamworth breeds, the lard hogs in the Poland Chinas, Duroc Jerseys, and Chester Whites. Intermediate between these two stand the Berkshires and the Hampshires. The lard type is heavily in the majority in our country, the Duroc Jerseys and Poland Chinas and their variations heading the list.

There are four methods by which hogs are bought by the packer: (1) in public stockyards; (2) in private stockyards owned by so-called "country packers"; (3) at shipping stations privately owned, though sometimes at a considerable distance from the owning packing-house; (4) by direct buying from farmers and others.

The public stockyard is the agency through which most of the country's crop which comes to market is sold. The hogs are consigned by their owners to one of the many commission houses located at each central yards. These commission houses, operating under the rigid rules of their local exchanges, as well

as of the National Live Stock Exchange, not to speak of the new federal law, the Packers and Stockyards Act, have developed a high degree of business integrity in caring for the interests of their customers. Millions of dollars a day are returned by these commission houses to their customers on the same day that the animals are sold, with only slight deductions for the inevitable expense of marketing, such as freight, yardage, feed, and a small fixed commission.

The great advantage to the packer of the central open market is that each packer has the opportunity of selecting the type of hogs which he desires from a larger assortment, and that he is not put to the necessity of depending upon a limited group of shippers, as the country packer, with his private yards, is more or less obliged to do. The country packer, on the other hand, has the advantage of furnishing a local market near by, which, if located in a populous hog territory, is bound to be patronized by a great many shippers who realize the inconvenience and dangers of shipping their animals to more distant points. By saving the shipper shrinkage, yardage, commission, and higher freight charges, the packer may buy his hogs correspondingly cheaper and yet give the shipper just as much for his hogs net as if they had been sold at higher prices at a more distant central market.

The method of buying in central markets is by open bids to the representatives of the commission houses, who stand near the pens of hogs consigned to

them. If buyer and seller agree, and this is generally done by a word or a nod, the drove is promptly driven to the public scales of the stockyards company, whose weights are binding upon both parties, and whose weight tickets in many markets constitute a negotiable document when indorsed, which can be deposited in a bank like a check. Spot cash is paid for all hogs on the day of purchase. The degree of integrity and fair dealing which has been evolved in the public stockyards of the United States is a development to which this industry may point with frank pride.

Chicago is the great central hog market of the country, and, except under disturbed conditions, prices at all other public markets and private yards tend to conform to the prices which prevail at Chicago, allowing, of course, for transportation charges. Prevailing prices are broadcast to other markets and to the country by means of the telegraph, telephone, and more recently the radio, as well as by daily live-stock journals published in all main markets.

It was said of a certain Scotchman that when he opened his purse a moth flew out. The packers have never been guilty of this offense against the agricultural community of this country. They have made the American hog as negotiable as a Liberty Bond. They have always recognized it as their duty to take over, regardless of the unknown future, all the hogs offered daily in the country's markets,

because once off the farm, the hog becomes a highly perishable commodity. All too often have they had to continue to take over more hogs than they could market at a profit. In that case their only consolation was the theory of the Maxwell Street clothing merchant, who, upon being asked by a customer how in the world he could sell all his suits at a loss, replied, "You see it's the volume."

This element of perishability, notably in its raw material but also in a large part of the finished product, is what makes the packing industry differ from the great range of manufacturing industries. A baker has a very perishable finished product, but a non-perishable raw material; the canner a perishable raw material but a very stable finished product. Most industries enjoy the luxury of having both their raw material and their finished products non-perishable, which allows them to do business with calmness and deliberation. They buy when they please and do not have to consider the million farmers who supply the packers with their raw material; they do not need to produce more merchandise than they think they can sell at a profit; they can arrange production schedules and sales campaigns and quotas, and their principals can take an occasional vacation. And this all revolves around the cardinal fact that they are not confronted, as is the packing business, with the bugbear of perishability. As Dr. Weld in a previous lecture put it, better than I have ever heard

it before, "the packing business must be managed from hour to hour, and is in reality a succession of crises," requiring continual executive attention and alertness. It contains an inherent element of caprice and speculation which cannot be avoided by even the most conservative of packers.

After purchase, the hogs are driven mostly in covered overhead runways to the packing-houses. In best practice they are rested before slaughter, since the meat is in better condition if they are killed after the excitement caused by driving them has passed. The animals are driven in small batches into shackling pens, where a chain is hooked to the hind leg and then connected to a revolving wheel, or vertical hoist. At the top of this hoist they are transferred to a sloping rail on which they are killed by an incision in the neck. The process causes little suffering, the animal becoming unconscious within a few seconds. From this rail the hogs are dropped, when dead, into a scalding tub held at a temperature of about 140 degrees, which serves the purpose of loosening the hair and superficial skin, called "scurf." They are then drawn into the machine which Mr. Cushman has rightfully called the key to all packing-house operation, the scraping machine. Here, by means of flexible beaters carrying dull steel knives and revolving rapidly, the hair and scurf are almost entirely removed, even from such difficult parts as head and feet. The hogs are then discharged on a

moving table, where the cleaning of the head and feet is completed. Here also a stout short gambrel stick is inserted under the tendons of the hind legs, and then hooked in the middle to a trolley on an overhead rail. The hog is then in a hanging position, head downward. The trolleys are brought into contact with the drop fingers of a conveyor chain running directly over the rail, which spaces the hogs about 24 inches apart, and in this way they are drawn successively past the various packing-house workmen, each of whom does a certain operation on each hog as it passes him. The speed of this chain is readily controllable by the foreman of the killing floor by means of a variable speed controller.

First the cleaning of the carcass is completed by the "shavers" who use long sharp knives for this purpose, and finally by means of high pressure showers before any cuts are made.

The next operation is the dropping of the head, whereupon the government inspectors immediately proceed to inspect the head lymph glands for the presence of disease.

The next operation is the removal of the intestines. This operation, which is done by a very skilful group of employees, necessitates great care so that neither the carcass nor the viscera are damaged. In a great many packing-houses the carcass is then weighed by inserting a quick recording scale into the

line on which the hog comes to rest long enough to be weighed. These weights are then compared with the live weight of the drove so as to arrive at the percentage of dressed yield, before any part of the carcass proper has been removed. Some packers do not compute their dressed yields until after the head, ham facings, and leaf lard have been removed, that is, when the hog is ready for the chill room.

The ham facings are removed by a very skilful piece of knife work, the ham facer being careful not to cut through the thin layer of connective tissue separating the ham muscle from the fat. If this is cut into, it affects the cure of the ham and its appearance when finally placed on the market.

The next operation is the pulling of the leaf lard, followed by the splitting of the hog, the splitter being required to cut through the middle of the backbone so that neither side is injured.

After a final washing, the carcass is ready for the chilling process, provided it has been passed by the government inspectors for food.

The inspection service, under control of the Department of Agriculture, has been steadily improved since the enactment of the inspection law in 1906, until it is today the most highly advanced in the world, and administered by a highly trained and well-seasoned corps of specialists who have become very expert in their work. They carry the heavy responsibility of safeguarding the public health with-

out needlessly destroying valuable food, the packer's property.

It is interesting to note in this connection that practically all the loss due to disease in hogs and other animals purchased by the packers, aggregating millions of dollars annually, is borne by the packing industry. While this situation is not equitable, and although its continuance works against the prompt eradication of live-stock diseases by relieving the grower of the live stock of the loss due to disease, the conditions surrounding this problem have been such that it is not practicable to attempt to pass this burden back to the producer.

Provision is made by the industry in their costs to cover average condemnation losses, but whether these or any other costs are recoverable depends entirely upon market conditions, and very often packers encounter exceptional condemnation losses which cannot be recovered.

This much is certain: the federal meat inspection service is so rigidly conducted that no diseased meat can possibly get to the consumer.

The slaughtering of hogs is interesting as the first manufacturing process to be carried out on the principle of moving the material past the operative at controllable rates of speed. This results in a degree of control and efficiency in operating large groups of men never before attained in industry, a principle of which other industries have since made

good use. The moving chain permits the dressing of hogs in some houses at the rate of five to six hundred an hour, at remarkably low costs.

The proper chilling of the hog is a matter of cardinal importance. Although it was formerly considered economical to allow hogs to hang for a number of hours after slaughter in an open well-ventilated room at outside temperatures, the best practice now prescribes that the hogs should be run immediately into the chill room. As Mr. Cushman told you in a previous lecture, the spray system of refrigeration is best for accomplishing the task of removing, as quickly as possible, not only the animal heat but about 3 per cent of the moisture from the carcass. The drying of the meat is just as important as refrigerating it, since excess moisture gives pork a flabbiness from which it never recovers, and which greatly hastens deterioration.

The standard time for chilling is between 36 and 42 hours; that is, the hogs are cut up on the second day after dressing. In some packing-houses, especially during the winter season of heavy production, a 20-hour chill is used, the hogs being cut on the day following the kill. Although this is feasible with the light carcasses, which chill readily, it can hardly be considered satisfactory with the heavier animals because of the deeper penetration of cold necessary. I believe that standard practice still indicates that in order to obtain the best results in the curing and

marketing of pork products the 40-hour chill is desirable.

The cutting of the hogs is the critical operation in the hog business. There are at least twenty or thirty different ways in which a hog may be cut up and it devolves upon the marketing division of the business, called the provision department, to determine which mode of cutting will yield the largest return on the animal. This is a very subtle problem, where decision one way or another, on account of the great volumes involved, means thousands of dollars of loss or gain to the packer. With most packers, detailed cutting instructions are issued weekly by their provision departments.

But another pitfall in the cutting of hogs is the improper making of the cut itself. I believe, packing-house superintendents will agree that no matter how skilful the knife-men may be, they will fall unconsciously into bad habits unless continuously supervised. This is notably the case in the trimming of bellies, where a great deal of meat can be cut away without this fact being apparent on the finished product. With hams, loins, and picnics, this danger is not so great, because the product has a standard contour. Yet operating men will agree that the problem of wasteful cutting is an inexhaustible study, worthy of the attention of the best brains in the packing-house; it always will be an operation which must be closely supervised.

In addition to visual supervision, proper cutting is checked in every well-regulated packing-house through the careful weighing, in groups, of all cuts produced, and then checking these "yields," as they are called, with the live weight of the hogs cut up. Long experience has taught us certain percentages of the live weight which the primal parts, meaning the main cuts, should aggregate. These vary with the size of the animals, and for a 250-pound hog are about as follows: hams, 13 per cent; shoulders, 10 per cent; bellies, 12 to 15 per cent; loins, 9 per cent; fat backs, 5 per cent; leaf lard, $2\frac{1}{2}$ per cent; rendered lard, 12 per cent; jowls and plates, 3 per cent; miscellaneous trimmings and offal, 5 per cent. Watchfulness over these percentages will give the manager of a packing-house valuable information as to how his hogs are being cut up. There is always, at any one time, a best way in which to cut up a hog, which can be determined only through practiced study of the markets and eternal vigilance on the cutting floor.

The cutting operation is another beautiful example of group work with the material flowing past the workmen. The hogs are dropped by gravity upon a moving table where the ham is sawed and cut off. At the end of this table it falls upon a block where, by means of a large cleaver, the shoulder is chopped from the middle of the hog. The shoulder is sent on a chute, or conveyor, in one direction, the middle in

another. From the shoulder the neckbone is first removed, whereupon the foot is sawed off with a band-saw and the shoulder then cut into whatever cuts the provision department has prescribed, such as butcher shoulders, New York shoulders, picnics, Boston butts, boneless butts, and blades.

On the hog middle, in carrying out the standard American cut, the ribs are lightly cut, parallel to the backbone, with a small special tool called a "scribe saw," whereupon the next workman, provided with a curved knife with two handles "pulls" the loin, leaving the fat back below intact and connected with the lower part of the side called the belly.

The next operation is the removal of the spareribs, whereupon the remainder, now boneless, is rolled flat in a special machine called a belly roller so as to permit proper cutting.

The fat back, or upper portion, is then separated by means of a knife from the lower. The proper location of this cut is very important, determining, as it does, the yield of bellies and fat backs.

The pork loins, spareribs, Boston butts, and all other small portions of the hog, which will be sold fresh, are immediately packed on the cutting floor into boxes, barrels, or other containers and sent to the wholesale market or cars for quick disposal to the retail trade. The remaining primal parts, such as the hams, bellies, fat backs, and shoulder hams, termed "picnics," aggregating fully 35 per cent of the

live weight of the hog, are generally dropped by means of gravity chutes to the grading rooms of the curing department, where they are accurately inspected for bruises and miscuts, and sorted according to weight. The small pieces of muscle and fat, trimmed off in making the various cuts, are carefully retrimmed, the meat being separated as far as possible from the fat. The meat trimmings are used in the manufacture of sausage, and the fat goes to the lard tank.

I have been unable to find out what gentleman arranged the first meeting between pork and salt. He did humanity a greater service than many a much-vaunted statesman "who struts and frets his hour upon the stage and then is heard no more." The curing of pork products has been a long and interesting evolution in which great progress has been made, especially in more recent years, until we are today able to control the quality of a cured pork product with as much certainty as a steel manufacturer can regulate the heat treating of his steels. In order to succeed in this, however, great skill and care are necessary, since slight variations of temperature during the curing process, or improper curing mixtures, work inevitably to spoil this desired result.

In general, three methods of cure are in use today. In the pickle process, the meat is placed into watertight receptacles, generally large oak vats about 4 feet high and 4 feet in diameter, into which from 1,200 to 1,400 pounds of the same cut, carefully graded as to weight,

is placed, whereupon the vat is filled up with the curing liquid, consisting of a carefully prepared mixture of salt brine, a sweetening material such as sugar or molasses, and a small quantity of saltpeter or nitrate of soda. The curing cellars must be held at a steady temperature between 36 and 40 degrees. The curing pickle must be chilled to this temperature before being placed on the meat. And a very essential part of the process is the "overhauling" of the meat; that is, throwing it at intervals, during the early part of the curing, from one vat to another so as to expose all surfaces of the meat to the conserving action of the pickle. The cuts on which the pickle is most generally applied are hams, picnics, and the medium averages of bellies. It takes from 40 to 75 days to cure a ham, depending upon its weight, from 20 to 30 days to cure a picnic, and from 20 to 30 days to cure these averages of bellies.

The second method is the dry salt process. This is employed on the rougher, less expensive cuts of meat. It consists in piling the meats carefully in the curing cellar with a sprinkle of salt between the layers. This cure also requires overhauling at intervals of about 10 and 20 days after putdown. It tends to dry and harden meats by leeching out the natural moisture.

The third method, which has come more and more into practice during recent years is the "dry cure," applied mainly to the light fancy bacon and other cuts

requiring great mildness. It consists in packing the meats very tightly into water-tight containers holding between 400 and 600 pounds with a slight sprinkle of salt, sugar, and nitrate between the pieces, and leaving the meats in this condition to cure in their own juices.

The aim of all packers in curing their fancy brands of meat is to attain that mild salt flavor which greatly heightens the natural fine flavor of the pork.

Salt is our main preserving agent. It penetrates steadily into the tissues of the meat under cure, until the deteriorating meat juices have been forced out and replaced by a salt solution which greatly reduces bacterial action and decay.

The main purpose of the sugar is to neutralize the brackishness and hard flavor of the salt, but it is also an important aid in the curing process itself. The nitrate, while contributing to the preservation of the product, serves mainly to preserve the bright red color of the meat.

The most interesting sequel to the curing process is the time-honored discovery of smoking, and all honor to the unknown hero who had that brilliant idea back in Neolithic times. The pungent fragrant fumes of burning hardwood impart to pork a flavor which can be obtained in no other way. But at the same time the meat is further preserved by a thin coating of creosote which the smoke deposits on its surface. In addition, a beautiful, appetizing brown

color is taken on by the meat, highly stimulating to the salivary glands of the purchaser. It may safely be stated that 80 per cent of all cured pork products is smoked before being sold to the consumer. They should be and generally are smoked near the place of sale, and only shortly before being marketed so as to preserve the bloom of freshly smoked product.

The fat trimmings, as previously stated, are rendered into lard, and when the cured market for fat backs, jowls, and plates is unfavorable, as compared with lard, these cuts also find their way into the lard tank. Two well-established methods of rendering are in use.

In the open-kettle process, the fats are hashed into a vertical steam-jacketed kettle open at the top, while a mechanical agitator keeps the fats in constant motion so as to prevent them from adhering to the heated walls and burning. When the cooking process is completed, the lard is drawn off from the remaining meat fibers, called "cracklings," and these cracklings then are pressed as severely as possible to remove the remaining lard. Cracklings are valuable as stock and poultry feed. The lard has a characteristic fine, nutlike flavor.

In the prime steam method the fats, in a closed tank, are subjected to about 40 pounds of steam brought directly in contact with the material. Under this great heat, which mounts to 270 degrees Fahrenheit, the lard is effectively separated from the tissues

and other residue, which sink to the bottom of the kettle with the condensed water of the steam, leaving the clear rendered lard above. This is then drawn off the side of the tank through draw-off cocks. When the slightest trace of water begins to show in the lard flowing from the tank, the valve is closed and the balance of the lard recovered by skimming the slush boxes into which the residue in the tank is then dropped. The tank water, which is a rich liquid containing valuable proteins in solution, is then drawn away and evaporated by means of a vacuum process; the more solid residue, called tankage, is placed into a hydraulic press to extract its surplus moisture. The pressed tankage and the tank water, evaporated to the consistency of molasses, are brought together again for final drying in a horizontal steam-jacketed dryer. This process will finally yield, with the admixture of dried blood, a so-called "digester tankage," which is a highly prized hog and stock food.

The lard obtained from the prime steam process is a standard world's staple, deliverable in lots of 50,000 pounds under prescribed regulations on the Chicago Board of Trade, both on a cash and future basis. It is not, however, finally consumed as a rule in its original state, in which it has a bluish cast and a rather heavy grain. It is almost universally refined by the admixture of very small quantities of Fuller's earth, which is then filtered out again. The lard is then quickly chilled by means of the revolving lard

roll, described by Mr. Cushman, and put into packages as a pure white, fine-grained product, called refined lard.

We cannot dismiss the subject of rendering lards and greases, however, without calling attention to a very recent improvement in this art, which promises shortly to revolutionize this department of the packing-house, and constitutes the greatest step forward in our industry during the last thirty years. It had long been recognized that the method of steam-rendering fats in closed tanks was not only wasteful in itself through the excessive use and condensation of steam, but that the subsequent evaporation of this condensed steam, in order to recover tanked materials, was an enormously wasteful process, costing millions of dollars annually in coal, labor, and equipment. "Why," asked some wiseacre, "add water to the lard only to have to evaporate it out again?" The result was the development of a small horizontal steam-heated cylinder containing an agitator and called a "fat melter." The fats are dropped into this heat chamber from above, rendered out quickly under great heat, and drawn off, the remaining cracklings are dried and rid of most of their fat content by further heat treatment, whereupon the remainder is pressed, if enough grease remains in it to make this necessary. The process is an adaptation of the open-kettle lard method. Startling in its simplicity, it does away with the need of slush boxes, tankage presses, evaporators, and dryers; requires one-third as much coal,

one-third the investment, one-third the space, one-half the labor, and yields a stock food 20 per cent richer in proteins than the old process. Added to this, it eliminates all trace of obnoxious odor in the inedible tank house. It is safe to predict that in the course of a very short time this revolutionary process will be installed in every packing-house.

There remains for us to consider the by-products of the hog, which are not nearly as numerous as those of cattle and sheep, since so much of the weight of the hog as we have seen, goes into food channels.

The blood of the hog is generally used in conjunction with tankage in the manufacture of stock food.

The casings, scrupulously cleaned and salted, are used as containers for those dainty sausages which, if properly made, constitute one of the highest developments of the packer's art.

The hair of the hog is cooked, washed, and dried, and finally finds its resting-place in automobile cushions and other upholstery.

The pork end of the packing business is the only branch which produces products of such uniformity and permanence that they can be traded in on a public exchange. The central market for these products is the Chicago Board of Trade, where prime steam lard, short ribs, and mess pork are traded in daily. The Board permits both packer and buyer to anticipate their wants or to protect their sales through hedging. It is an invaluable adjunct to the packing business.

No study of the hog business would be complete without a discussion of the very interesting theory by which hog costs are computed. Many an otherwise good accountant or trade commission has foundered on the rocks of this problem. It is only through intimate acquaintance with the business that the necessity of treating hog costs as they are treated can be realized.

There are in general three methods of cost finding in use today. (1) ordinary cost; (2) major and by-product cost; (3) joint cost.

The simplest of these, "ordinary" or "cumulative" cost, exists where raw materials of known cost, labor, and a proper share of overhead, are added together to make the cost of the finished product. Practically all industries are included in this category, such as building operations, clothing, hardware, furniture, automobiles, etc. Since so many industries figure their costs in this way, and since the method is inherently simple, its problems are fairly well understood. The simplicity of these costs is due to the fact that these industries produce no by-products of any value.

The second type is "major" and "by-product" cost, existing in those industries where there are well-defined by-products, whose importance is, however, distinctly secondary to the major product.

Examples of this type are the illuminating gas industry where the by-products are coke and coal-

tar; the cattle business of the packing industry, where the principal by-products are hides and tallow, and the sheep business of the packing industry where the principal by-product is wool. To arrive at the cost of the principal product under these conditions, it is necessary to add to the cost of the raw material the labor and proper overhead involved, crediting this amount with the net value of the by-products. The remainder is then divided by the number of pounds of major product produced, and reveals its cost per pound.

Under conditions of joint cost, however, an article of known cost, like a dressed hog, is broken into many products concurrently, such as loins, hams, bellies, shoulders, lard, spare ribs, pig tails, pigs feet, etc., no one of which can properly be considered the major product, and on no one of which a cost can be obtained. They are in different demand and there is a constant shifting in their relative market values. To use the average cost on all these cuts would be entirely valueless, since there is no relationship between the value of the cuts and their average cost.

The only method then that we know of determining the return on hog operations is to arrive at the total daily or weekly outlay in the form of hogs, labor, and overhead, and to credit this with the net market value (that is, the full market value less expense of further processing, shrinkage, selling, and so forth) of all the products which the hog produces. The differ-

ence represents the profit or loss on the whole transaction. This takes no account, however, of possible market changes by the time the cellar products are marketed.

There are only two ways in which a packer can make a profit on his hog operations: (1) If the hogs "cut out"; that is, if the combined value of the cuts is greater than the raw material plus expense, and provided he sells them. Strangely enough this devoutly welcome condition has occurred during the last four years for only a few weeks each year. (2) When the hogs do not cut out, the only chance he has to come out is through a rise in the products he stores away out of these hogs in cellar, freezers, and lard.

In the period before the war the packer could depend with reasonable safety (panics, etc., excepted) upon an annual cycle of hog receipts and price movements. A large run of hogs would arrive in the winter, out of which large quantities of product were packed away. In the early spring, while the farmers were busy in the fields and during the lull between the winter run of pigs born the previous spring, and the summer run of pigs born in the fall, receipts would fall off and hog prices would rise. This secondary summer run, usually occurring in late May and June, would cause a drop in hog prices, but not to the winter level. This over, there was a very marked decrease in hog receipts in August and September, and during this time of light receipts the winter accumulation of

product was marketed generally at prices which justified taking the risks and borrowing the money to accumulate the product.

Since the war, however, there has been an unmistakable change in the manner in which hogs are coming to market. Through their producers' organizations the farmers have learned to breed and feed their hogs so that more can be sent in during seasons of greater scarcity. This change in the character of the hog run, although probably subject to variation, according to business conditions and economic factors such as the price of corn, is undoubtedly here to stay. It remains now for the packing industry to adjust its habits of thought, ingrained by a half-century's experience, to the change, and to realize the danger in accumulating large stocks during the winter packing season to relieve a summer and fall scarcity, which does not materialize. The only exit from this dilemma is to put the business as far as possible upon a manufacturing basis, under which expenditures for raw materials, etc., can be recovered currently out of the product produced from those hogs.

Some thought is also being given to the kindred problem of pricing inventories. This problem arises at the end of every packing-house accounting period, occurring usually every four to eight weeks. Previous to the post-war period, it was possible, on account of the fairly dependable movement of prices during the

packing-house year, to inventory pork stocks on the basis of their market value. The practice is now advocated of pricing those stocks which must be accumulated and which cannot be hedged at acquired cost or market, whichever is lower, as it is done in the great range of manufacturing industries.

Pork packing is uniquely an American industry. It is the product of American brains and energy, built without much precedent from Europe. The American pork packer, and especially the larger packer, has rendered a service which the public is just beginning to recognize. He has built the vast organization, and supplied the marvelous and original technique by which these highly perishable products are distributed in fabulous volume over land and sea, through all climates, into every corner of the globe.

Packing is simply a phase of agriculture. The packer is the farmer's holding company and fiscal agent. Standing side by side, these two have carried American agriculture to a supremacy attained in no other country. For the risks he has taken and services he has rendered, the packer has claimed a profit which for the last twenty-five years has averaged but $2\frac{1}{2}$ cents on each dollar of sales, a fraction of a cent per pound, or about a nickel a week for each family residing in the United States.



E. A. CUDAHY, JR.

Lecture VI

FINANCING THE PACKING INDUSTRY

BY

E. A. CUDAHY, JR.



FINANCING THE PACKING INDUSTRY

The packing industry as we know it today has grown up since the Civil War. In 1865 every town or city had its slaughter house. New York City had more than two hundred, and what is now Fifth Avenue was often encumbered by large droves of cattle. Great stockyards occupied territory that now provides sites for clubs, hotels, and the highest class of retail stores.

The growth of the packing business has paralleled that of other large American undertakings. Before the Civil War such long-established agencies of everyday business as transcontinental railways, European cables, telephones, electric lights, and trolley cars did not exist. Skyscrapers, million-dollar hotels, and automobiles were far in the future, while flying machines and wireless were beyond the realm of imagination. Safety razors, pneumatic cleaners, and the thousand and one other contrivances that add convenience and comfort to modern life had not then taken shape in the inventor's brain. In those simple days we did not know the meaning of "trust," "restraint of trade," "interlocking directorate," "holding company," "subsidiary," "underwriting syndicate" or "community of interest"—those phrases and institutions that have since given our legislators and our courts much concern.

The years of the Civil War and those immediately following revealed the necessity for a change in banking methods that finally resulted in The National Bank Act. This act provided for the issue of national bank notes, protected by deposit of government bonds with the United States Treasury. There were numerous other features in the act, all intended to make the notes absolutely secure and of equal value everywhere in the country.

The national banking system was not fundamentally changed until 1913, when the Federal Reserve Act was passed. This law brought about the creation of federal reserve banks in various centers, all supported by the banking resources of the country. The power of note-issue and the conditions under which it became profitable to issue notes were calculated to add the element of flexibility to our currency, preserving at the same time the security and the uniform value that had been achieved in the national bank notes. The Federal Reserve Act took for granted the great private banking institutions that had grown up alongside the other large business concerns of the sort above mentioned, and undertook to weld them into a financial system, capable under all circumstances of serving the nation and the nation's business.

It is through these banking institutions that make up the financial system of the country that the packing industry along with other business concerns through-

out the land is financed. Financing the packing business is the consummation of a trade between the producers of live stock and the consumers of meat. The packer, assisted by the banker, makes it possible for the consumers to buy the meat-animal which the stockman has raised. The packer, of course, takes a financial risk. He acquires the title to the live stock and pays cash for it in whatever quantities it comes.

Consider the simple case of a packer who wishes to buy, dress, and sell a farmer's pig. Since the purchase must be on a cash basis, it must be financed. If the packer has not sufficient free funds, he must borrow. When he has borrowed the money and bought the animal, he cannot get his money out of it without doing work on it. The consumer does not eat pig; he eats pork. To convert the pig into pork and other hog products ready for sale means more money. Plant, equipment, and operations are required. The man who hoists the pig, the man who slaughters it, the men who dress it, the men who push it or cut it or pack it or make out bills for it or write letters about it—all these and others have to be paid. The packer must borrow enough to meet his pay-roll and to keep his plant in good order as part of the process of turning the pig into pork and selling it.

When finally the packer has turned his pig into pork, he finds that only the fresh pork can be sold immediately. Other cuts must be put into cure

for one, two, or perhaps three months. This means spending more money; wages to the man who salts them, to the man who lifts them out of one vat into another, to the man who examines them to see whether they are cured, to the accountant who keeps track of them, to the auditor who changes their value on the books as the market changes, to many others who contribute to the final result. There are also disbursements for many things beside wages. All of these expenses must be financed until the products can be sold. At last the cured meats are offered on the market. But the market has been oversupplied; the packer is forced to look for buyers outside of the day-to-day domestic demand.

An Englishman finally buys the bacon, a man in Holland takes the lard, a Boston retailer purchases the hams, a member of the board of trade contracts for the fat back, and, in the course of a month or two, receipts of hogs become light and the packer takes the shoulders out of cold storage and sells them. If he is lucky, he gets his money back and a small profit in addition. He must repay with interest all he has borrowed, pay all expenses not already met, and, if possible, give the stock-holders a fair dividend on their investment. He has made it possible with the help of the banker, the retailer, and others for the farmer to sell his pig to the consumer. Multiply the operations just described by the vast number of pigs slaughtered, and of cattle, and of sheep, and of

calves, and you get some idea of the magnitude of packing-house finance.

The best way to gain an understanding of the means and methods of financing this industry is first to consider the day-to-day transactions and, second, the major or long-time operations. Under the first caption the packer's main item of expenditure is payment for live stock. Every dollar of value in finished products of the slaughtering and meat-packing industry, according to United States census figures covering the year 1919, represents a payment for raw materials, principally live stock, of about 89 cents. The first concern of the packer is to have the funds on hand to pay for his daily purchases of live stock. Most of this money comes from his sales, the proceeds of which are transmitted as quickly as possible to live-stock centers, so that additional supplies of live stock can be purchased.

The packing industry in value of its output is the largest in the United States. According to government census figures covering 1,304 establishments for the year 1919, live stock purchased amounted to \$3,056,387,778, approximately \$10,000,000 per day. Of all the live stock slaughtered in the United States during 1922, 35,000,000 head, or in the neighborhood of 35 per cent, were slaughtered in establishments which do not maintain federal government inspection, and 67,000,000 head, or around 65 per cent, in federally inspected houses, by packers

who have their establishments at central stockyard markets or who buy at these central markets.

The purchase of all live stock at central stockyard points is made by verbal agreement between the buyer and the seller. At the end of the day's business, a purchase slip is made out in the live-stock office of the packer, showing the number, total weight, and average price per hundredweight of each lot of live stock bought. There may be anywhere from one or two head to two or three hundred head in a lot. The different buyers review these figures before payment is made. All live stock is paid for the day it is purchased, either by check or by duly authenticated invoice of the commission firm, which must bear the signature of the head live-stock buyer. The commission man then deposits the check or invoice from the bank to his credit, and the live-stock owner receives from the commission man the net returns of his sales either in cash or draft. Often the live-stock man after disposing of his live stock will reinvest his proceeds in additional cattle, to be shipped to his farm for feeding and later returned to market. The fact that the buyer for a number of firms will purchase 3,000 hogs a day, totalling approximately \$60,000, and that a single cattle buyer for an equal number of firms will buy 1,000 cattle a day, totalling about \$100,000, and that all these transactions are accomplished verbally with practically no misunderstanding speaks well for the caliber

of men who are employed by the packers as buyers and of the men found in the commission business.

To carry on various manufacturing processes the packer must be a large purchaser of containers, fuel, ice, salt, and sugar. These items, according to the census figures, cost the 1,304 packers, covered by the figures for 1919, \$425,664,430. Bills for these articles have to be met, and the packer whose financial position enables him to do so accepts the cash discounts (in most cases 1 per cent or 2 per cent for payment in ten days or net thirty days or net sixty days) rather than take the extended time of thirty to sixty days without such discount. This prompt method of payment is of equal advantage to both seller and buyer. One per cent ten days, net thirty, is equivalent to an annual interest rate of 18 per cent; 2 per cent ten days, net thirty, is equivalent to 36 per cent annually.

The pay-roll is another large item that must be met at regular intervals, in most cases weekly. According to the census report for 1919, just cited, these 1,304 establishments paid out in wages and salaries to 197,392 employes \$269,174,628, of which seven-ninths represented wages. Distribution of labor pay-rolls is generally made by check. In order to have funds on hand with which to meet these checks, the packer, a day or two before the checks are issued, deposits with his bank, or, if he carries a general account with the bank in question, will have

the bank transfer to his special pay-roll account sufficient funds to cover the checks to be issued. These checks are of a special design and there is a time limit for their collection. This is to prevent their being raised and to insure their prompt return for cancellation.

From the foregoing you will readily see that the packing industry, so far as we have gone, is pretty much on a cash basis. The fact that live stock is paid for the day it is purchased, that pay-rolls are met weekly, that purchases of supplies are in most cases paid for ten days after the receipt of invoice in order to take advantage of cash discount makes it necessary for the packer in turn to sell his goods on short-time credit.

Selling organization varies with the size and location of the business. Many packers do a very large business in the single state or city in which they are located, and sell almost exclusively on weekly terms. Others, in addition to localized business, distribute their goods on one or more car routes. In the car-route method of selling, the salesman goes over his route from town to town each week collecting for the previous week's sales, and selling for the following week's shipment. Large packers also maintain branch houses, the largest having as many as three or four hundred branches.

Meat products are sold through branch houses and on car routes almost exclusively to the retail

trade. Collections from retailers for fresh meat, or mixed sales of fresh meat and provisions are made weekly; in case of straight provision, sales thirty days net is the usual practice, except for lard, which is sold $\frac{1}{2}$ per cent ten days, thirty days net. Thirty-day terms are confined almost exclusively to southern trade. Carloads of either fresh meat or provisions are usually sold sight draft attached to bill of lading; canned meats $\frac{1}{2}$ per cent ten days, thirty days net.

In the case of export sales, the packer either ships provisions and lard on consignment, books what are known as open-price orders, or sells on C.I.F. terms, depending upon the type of his organization. If a packer maintains his own foreign branches, he will ship on consignment; collection will be made by his foreign organization, and the money deposited in central banks in the various countries and drawn to this country by cable transfer. Packers who do their foreign business through agents put the goods on board ship, present all documents to the banks, and, according to the arrangement made, draw 60 to 80 per cent of the value of the goods, against the agent.

Open-price orders are booked for goods, the price of which by mutual agreement between buyer and seller is to be fixed at the market price on arrival. The packer will draw on this kind of order to the extent of 60 to 80 per cent. C.I.F. terms represent a delivered price, comprising cost, insurance, and

freight. Drafts for this type of transaction are drawn on the agent to the full extent of the value of the sale.

As the packer's sales outlets become more diversified, his collections become more difficult, especially if he has a number of branch houses a considerable distance from headquarters. Collections are generally accomplished either by the salesman who sold the goods or by collectors. Banks will also make collections for a charge of $\frac{1}{4}$ to $\frac{1}{2}$ of 1 per cent, but this method is often objectionable. The good will of customers is an important asset, and most packers exhaust every other means for collection before placing a delinquent account in the hands of an attorney.

The usual method is for the salesman or collector to call on a customer for payment when the bill is due. A valid excuse is promptly accepted, and another order taken. If the account is not paid after two or three efforts to collect, the central credit department steps in. If the customer still refuses to pay, the collection department writes him a letter. Correspondence of considerable length may develop, and often results in settlement without dissatisfaction. If the customer does not reply, it is time to draw a draft against his account, have it protested to prove refusal to pay, and place the matter in the hands of an attorney.

The collection department is, of course, closely allied to the credit department, under authorization

of which it does its work. The duties of the credit department are to gather information in regard to old customers whose credit limit should be increased or decreased, and to adjust this limit, or, in the case of a new customer, to set a credit limit or put the name on the C.O.D. list. The necessary information is obtained principally from credit agencies and banks. Keen intelligence and good judgment are essential to the successful handling of credits.

The packer must possess a very efficient credit department, especially if his business is growing. Often a man can be made a customer for life by risking a credit of \$50 on him when others have refused to sell to him except C.O.D. On the other hand, many a customer who should have been sold on C.O.D. terms has been advanced \$50 and the money has never been collected. A concern that deals direct with retailers finds it much more difficult to get accurate credit information than do manufacturers who sell to wholesalers or jobbers.

To facilitate collections through branch houses, a packer requires the branch to make out and forward to the general office, weekly or monthly, trial balances. This is a form which shows the name of each customer, how much he owes, when it is due, and his credit limit. These lists are checked over carefully either by the credit man in charge of the territory in which the branch house is located or in the general office. All delinquencies are followed up directly or through

the branch-house manager to hasten payment. The desirability of prompt collection, as already pointed out, is obvious. If collections are slow, it means that the packer has to borrow more money to finance his live-stock purchases, his purchases of supplies, and the product he is forced to carry either in process or in cure in his plant. The average length of time during which bills of this nature are outstanding varies with the different packers from twelve to thirty days.

As the branch house makes collections, the cashier deposits the daily receipts in the bank; one copy of the deposit ticket is sent to the central office, one to the bank, and one is retained in the branch house. As funds accumulate in the bank, the central office computes the deposit slips and draws a draft for the amount of the company's credit. In this manner funds accumulated from fresh meat sales in New York may be transferred to Kansas City for buying live stock, or funds acquired in New Orleans from the sale of hams and lard may be transferred to Chicago for buying coal.

One of the difficult questions to be solved is the selection of customers. In a large sense, credit is the confidence which is reposed in the ability and purpose of men to meet future obligations. Although based upon faith in human nature, the institution of credit presents many phases in which this factor plays a small part. Personal credit rests solely upon

the good faith of the debtor, but it could not have gained its prominent place in the development of commerce without the use of many instruments, such as drafts, notes, mortgage bonds—all used with the common purpose of safeguarding the claimant. This not only protects those who have advanced money, but, in a country where credit is as highly organized as in the United States, any of these instruments becomes negotiable.

We have seen how a packer utilizes his own capital in financing his business. Beyond this, borrowed capital plays an important rôle in the industry. In 1919 the amount of capital owned and borrowed and actually invested in packing amounted to \$1,176,483,643, and in the same year the production of beef, pork, lard, and mutton totalled 18,700,000,000 pounds, which is equivalent to approximately 60,000,000 pounds or 2,000 carloads daily. In 1922 the minimum and maximum stock of products in storage was as follows:

	Meats and Lard	Pork	Lard
Minimum	548,546,000	395,127,000	32,455,000
Maximum	971,888,000	707,646,000	154,826,000

Exports of packing-house products for different years were as follows:

1919	\$985,011,330
1920	449,015,777
1921	287,066,724
1922	245,874,483

Owing to the fact that live stock is paid for in cash; that it is to the advantage of a packer to discount his bills for purchases of supplies; that it is necessary for him to accumulate supplies of meats in cure and storage; that by-products must be put through manufacturing processes which take considerable time, and then often have to be carried for months before sale is effected—these and other circumstances mean that the packer operates to a large extent on borrowed capital, obtained principally through bonds, debenture notes, bank loans, and commercial paper.

Variations in the financial policy of packing firms and in the efficiency of their management almost equal the number of firms. It is most difficult to say when or for what purpose a packer has occasion to borrow money. A business cannot stand still. It must go either forward or backward. Assuming that a packer is aggressive and desirous of expanding his business, he finds that financing himself entirely out of his earnings is rather slow, and he must go to an investment or banking house to seek funds.

When money is plentiful and rates of interest reasonable, it is sometimes advantageous to do his long-time financing by means of bonds or debenture notes. On the other hand, when there is a shortage of working capital, interest rates are unfavorable to long-time financing.

It might seem to the casual observer that when the packers, the larger ones in particular, need money

they might secure it, with practically no difficulty, by any of the four methods mentioned. The packer, however, is subject to the same scrutiny and investigation on the part of bankers of whom he asks credit, as he imposes upon the smallest of his own retail customers.

A firm will need new funds for some one or more of the following reasons:

1. To expand an old business along old lines.
2. To expand an old business in a new direction.
3. To buy out competitors or to combine with them.
4. To provide temporary working capital.
5. To change the type or terms of existing capital liabilities.
6. To refund or provide the means of payment for maturing security issues.
7. To change the ownership or form of organization, or to enable present owners to withdraw their capital, or, in cases of reorganization, to adjust conflicting ownership and creditor interests.

Of the various forms of borrowing that may be employed to meet these needs the negotiable mortgage bond doubtless gives the best security to the lender.¹ Such a bond may be defined as a secured promissory note, or in other words a promise on the part of a corporation to pay a certain sum of money at a

¹ The following definitions of bank accommodations are taken from *American Business Manual* by R. H. Montgomery.

definite time, with interest periodically. As a rule, mortgages cover only the fixed assets; that is, plant, equipment, real estate, and the like.

Since the average packer borrows frequently from the bank, and the bank must look for security of its loan to the strength of a company's current assets (cash on hand and in banks, accounts and bills receivable, liberty bonds, inventories of products, materials and supplies), it is obvious that from the commercial bank's point of view it would not be desirable that there are any prior claims to be based on current assets.

Debenture notes are sometimes issued at a high rate of interest, usually 8 per cent, in order to increase the working capital of concerns whose current assets have become frozen. Frequently provisions protecting earlier preferred-stock issues against the creation of any mortgage obligations have cut off all avenues of emergency financing except that of the note-issue. Under such circumstances it is to be expected that protective covenants will be imposed. Such a covenant would provide that while the notes are outstanding the company shall not further mortgage or pledge any of its assets except for the acquisition of additional property. In case property is acquired, the purchase money obligations are usually limited to a conservative percentage of the value of the newly acquired property.

Another protecting covenant is one that requires the net tangible assets of the company to be main-

tained at an amount equal to at least 200 per cent of the outstanding notes, while the ratio of quick assets and current liabilities is kept up to a certain stipulated minimum. It is sometimes required that the working capital or net-quick assets shall always be kept equal to, or greater than, the amount of notes outstanding. During the past few years it has sometimes been necessary for a concern to issue mortgage bonds at a high rate in order to secure sufficient working capital and enable the borrower to avoid a technical default on his debenture notes.*

If the company defaults in the payment of principal or interest on bonds, a mortgaged property can under certain conditions be foreclosed by the trustee for the benefit of the bondholders. When bonds are secured by collateral, they become due and payable after a certain interval has elapsed following the default on the part of the issuing company. The collateral may then be sold to satisfy the claims of the bondholders. If a company should default in the carrying out of its obligations in connection with a debenture bond, the holders of the notes can presumably throw the concern into receivership, which will be operated for the benefit of creditors until such time as the defaults shall be made good.

The better grades of bonds issued by industrial corporations will sell, according to circumstances, from four to five points higher than is received by the

borrower. Under very special circumstances the spread may be even greater. For example, an investment house might pay ninety-four or ninety-five for this type of security and sell it to members of the syndicate for ninety-six or ninety-seven. The latter in turn might offer them to the public at par. Lower-grade bonds, debentures, and preferred stock are frequently subject to a greater spread, while in the case of common-stock, aggregate commissions to the different distributors may be as high as 10 per cent or event 15 per cent of par. These figures, of course, refer only to the practice of reputable investment houses which handle securities properly considered in the investment class, though with varying degrees of desirability.

Commercial paper, with or without indorsement of individuals as well as the issuing corporation, is simply unsecured promissory notes issued by merchants and manufacturers to secure funds with which to finance current transactions. Such notes are sold by commercial-paper houses and note-brokers and are not given directly by the borrower to his bank. Certain types of business do not, as a rule, find it possible to sell their paper on the open market. Among these are:

1. Producers or distributors of highly fashionable goods and luxuries.
2. Lines of business in which turnover of inventory is very slow; for example, heavy machinery.

3. Concerns engaged in handling products that are subject to rapid fluctuation in value, and for which the demand is not definitely fixed.

4. New concerns, which have not yet demonstrated their stability even though handling a staple commodity.

The packing industry, in general, meets requirements for commercial-paper borrowing, and concerns of established credit use it extensively. Both large and small banks make a practice of buying packers' commercial paper at times when they have surplus funds to loan for a short period of time. The notes are usually turned every three to six months, and the broker's minimum commission is $\frac{1}{4}$ of 1 per cent for six months' time.

The advantage claimed for commercial paper is that through it the borrower can obtain a lower interest rate than is offered by his bank. This is debatable. The principal use that the packer makes of commercial paper is during time of accumulation of product, especially in winter when hog receipts are heavy and pork products have to be put in cure in large quantities and carried three to six months or longer before they are sold. During such a period a packer may have utilized to the full his line of credit with his different banks, in which case he secures his additional funds by disposing of commercial paper in the open market.

The packing industry acquires the largest part of its current borrowed funds from bank loans. Accord-

ing to the size of the business, a packer establishes what is called a line of credit with one, a few, or many commercial banks. This means that an officer of the bank, after a thorough examination of the condition of the company, pledges his word to advance funds within a certain limit set either by the size of the bank or of the borrowing concern, or by the financial condition of the company. In return for this accommodation the bank will require a deposit, ranging from 10 to 20 per cent, on which the borrower receives no interest. Some banks consistently require that the full percentage of the line shall be maintained year in and year out, even though the line is rarely used; others impose practically no requirements upon the borrower when his line is not being used. Other banks will require the borrower always to maintain a certain minimum of deposit on a loan, 10 per cent for example, even though it is not being used, and then require the usual 20 per cent balance when loans are actually made. Another plan is to keep on deposit a rough average percentage of the actual borrowings. The method used depends, among other things, upon local custom, size of the bank, importance of the business, character of its management, and the type of industry.

A bank asked to extend a line of credit to a concern will probably consult other banks regarding their experience with it, and it will scrutinize carefully the latest *Dun and Bradstreet* reports. It will also compare

the latest balance sheet furnished by the borrower with the balance sheets of several previous years, thereby securing a financial history of the business. After all these precautions, it is a common practice to insist upon an annual clean-up of commercial loans irrespective of the nature, size, or age of the business. This means that all outstanding loans are paid and that the borrower does not again ask for loans within sixty or ninety days.

A great problem which confronts the packer or, for that matter, any other business man, is to keep his capital profitably employed. A successful concern, at the end of the year, may either reinvest its profit in the business in the form of improvements—added manufacturing or selling facilities—add it to working capital in the form of surplus, or invest it outside the business. In a large and growing packing business it requires a nice balance, rare judgment, and good management to keep capital profitably employed and at the same time not to expand to the point where tight money or poor business will mean financial embarrassment.

During the past few years we have read and heard a great deal about frozen credits. In a time of depression a firm may be caught with an unduly large quantity of goods on hand. Being unable to sell its products, and having too large a part of its capital tied up in inventories, the concern must seek relief from the banker. The firm may be solvent and still

the loan may be undesirable from the banker's standpoint. Nevertheless, he may stand to lose more money by forcing the customer to liquidate his business than he would if he loaned him money to tide him over. Credits extended or continued under certain circumstances of this sort are termed, "frozen credits."

Negotiable instruments.—A promissory note is an unconditional promise by one party to pay a certain sum of money to a second party or his order at a specified time.

A bill of exchange, commonly known as a draft, is an order sent by one person or firm to another requesting the payment of a certain sum of money at a certain time to a third person or his order. There are both foreign and domestic bills. All domestic bills are bills of exchange or drafts, and, next to the bank check, are most widely in use in commercial intercourse. The only formal difference between foreign and domestic bills is that the former are made out in triplicate, numbered consecutively one, two, and three, and sent to their destination by three different routes to lessen the probability of all of them being lost. Receipt of any one of the three cancels payment of the other two.

The handling of foreign bills brings in the question of foreign exchanges or conversion of the money of one country into the equivalent in the money of another. Exchange operations are based on the

principle of the cancellation of indebtedness, and can be illustrated by a simple example: A, a merchant in New York buys goods of B, a merchant in London. It is safe to suppose there is a third party, C, in London, who has bought some goods in New York, so that instead of shipping gold across the ocean, A in New York goes to his banker in London and buys a draft on London. C goes to his banker in London and buys a draft on New York. In this way the two debts cancel each other without the actual use of money.

This must be multiplied by hundreds of thousands of transactions of this nature between nations. Under typical circumstances any difference between the balance of trade to different points makes the exchange either for or against that nation; for instance, if the balance of trade is in favor of England, London exchange will be at a premium over New York, while if the balance of trade is in favor of America, New York exchange will be at a premium over London. Just now, during the large accumulation of the world's gold supply in this country, there may be at times favorable foreign exchange even when there is an adverse balance of trade.

These bills are dealt in just the same as beef, cotton, wheat, or any other commodity. If this system of transfer of credit were not in effect, it would be necessary for A, the merchant in New York, to ship gold or silver to London, and he would have

to stand the charge of transportation, interest, insurance, and loss in weight.

At the present time American exchange is on a parity with that of Switzerland and a few other countries, but is at a premium with the exchange of most of the nations in the world, because we are a creditor nation, and, as just mentioned, have a large part of all the gold in the world. This condition came about through debts that foreign nations incurred during the war and through the large imports from the United States during and since the war. In other words, the resources of this country are so great that we produce more than we need, and ship the surplus over home-consumption to nations less fortunate that lack productivity of raw materials and unfinished merchandise.

A check is a draft or order upon a bank for a specified sum of money to a third person or his order, or to bearer, payable on demand out of the amount which the person giving the order purports to have in the bank.

A bank note is a common form of promissory note, payable to bearer on demand. Unlike the ordinary promissory note, it is designed to circulate indefinitely as money. Although treated as money, bank notes are not legal tender. They are secured by deposit of government bonds with the treasury or by the deposit of certain kinds of commercial paper under the Federal Reserve Act.

A bank draft is a check drawn upon one bank by another, payable on demand. This is used mostly by banks to transfer funds for the accommodation of customers, or for the regular transaction of business. For instance, a New York bank, to facilitate the business of its customers, will carry an account with a London bank and use a bank draft to transfer funds. In like manner, country banks maintain accounts in banks in larger cities to meet the needs of customers, and the transfer of funds from one point to another is accomplished by issuing a bank draft.

A certificate of deposit is issued by a bank in acknowledgment of receipt of a sum of money, which the bank also promises to pay to a depositor or his order upon surrender of this certificate.

Another method of borrowing is by warehouse receipt. The procedure is as follows: a packer places his meats or lard in a board of trade licensed warehouse, subject to its rules and regulations. There are concerns in the warehousing business, but a packer may have one of his own buildings declared a "regular" warehouse provided it has the approval of the board of trade inspector. When packer-owned cold storage has been declared "regular," and dry, salt, short ribs, barrelled mess pork, or prime steam lard, which will pass the board of trade specifications and inspection, has been placed in this storage, or the product stored with an outside concern which does a warehousing business, a board of trade warehouse

receipt is issued for the product, showing the packer to be the owner of the goods. He may borrow from the bank on his promissory note secured by the warehouse receipt. It is a penitentiary offense to remove the product without having the registration of the receipts cancelled. Because of possible fluctuations in price it may not always be possible to borrow the full face value of the goods. Pending the time of withdrawal, the margin the banker desires for his protection may vary from 10 to 25 per cent.

There is very little trade credit (also called "dealer credit") in the packing business. This kind of credit is confined mostly to the agricultural implement business, piano manufacturing, distribution of furniture and store fixtures and printing machinery, sewing machines, and similar types of goods sold through canvassing agents. In such cases installment notes are usually taken from the customer, and under a conditional sales-agreement the actual ownership rests in the seller until all payments are made. Notes sometimes run as long as two or three years, with periodic payments. Such notes can ordinarily be discounted or pledged as collateral for loans up to a considerable percentage of their face value. Certain types of companies that sell goods in this manner often thrive because of default of payment by their customers, which makes it possible to recover the goods and sell them as new.

Another method of raising borrowed funds is by mortgage issue. Corporation mortgages constitute the simplest means of borrowing long-time funds. This form of credit, in which an ordinary mortgage is given on the company's real property, is used only by small firms. The common practice for larger concerns is to offer mortgage bonds to the public.

Many businesses can be run without encountering the necessity of borrowing much, if any, money. The original capital and past earnings in the form of surplus are sufficient, with an occasional bank loan, to meet all financial needs. Most packers, however, are large borrowers of money in almost every form in which it is available. This is due to the fact that the industry is one of cash payment and frequent small sales to retailers; also to the necessity for accumulating cured and stored supplies of meats on account of seasonal marketing of live stock. It is necessary also to supply funds for the processes of manufacture involved in the handling of by-products.

A great deal has been said about the heartless corporation.¹ The corporation has now become the predominant type of business organization. Beside the corporation there are also joint-stock companies and partnerships and, simplest of all, individual

¹ The following discussion of corporation, partnerships, individual ownership, etc., follows closely the discussion by Lincoln in his book, *Applied Business Finance*. The author has not hesitated to use Mr. Lincoln's language in definitions and other matters of exact statement. Owing to the necessity of adaptations to fit the present text, quotation marks have not always been possible.

ownership. Each of these types of organization has its advantages and drawbacks. For instance, the advantages of an individual ownership are:

1. It is very flexible from a legal standpoint.
2. In administration the individual is wholly independent of others, and makes his decisions without delay or interference.
3. This form of ownership avoids many of the obligations and expenses which must be incurred by other firms, particularly by corporations.
4. Individually owned enterprises are not required to file public statements of any sort, or to take others into their confidence; they can have their operations kept wholly secret.

The drawbacks to individually owned and controlled enterprises are:

1. Such a business is rather definitely limited as to the amount of capital which can be secured from outsiders; not many methods of financing are open to it except that of reinvesting earnings.
2. The owner naturally assumes a heavy risk, inasmuch as all his assets, whether involved in the business or not, can legally be attached for the payment of debts contracted in the business.
3. Upon the death of the owner there is every possibility that the business will be wholly disrupted.

The advantages of partnerships are:

1. The agreement which brings the partnership into existence is based on private contract, not on a

franchise from the state; greater flexibility may therefore be secured.

2. Such a form of organization makes it possible to secure a larger amount of capital, and permits much more flexibility in financing than is possible to individually owned enterprises.

3. It is clearly possible for the partnership to secure good managerial ability and for individual partners to become specialists along particular lines.

4. All partners not being legally distinct, and every partner having unlimited liability and responsibility for the obligations and sections of the partnership, its credit position may presumably, in certain cases, be stronger than that of an individually owned enterprise or of a corporation.

The unsatisfactory features of a partnership are as follows:

1. It is frequently difficult to find wholly congenial partners, or to maintain altogether pleasant relations even after a partnership has been formed. Any dissension arising may seriously weaken the credit position of the concern.

2. The partnership form of organization is inevitably somewhat limited in attempts to raise new capital, since the obvious way to secure additional funds aside from reinvesting earnings is to take in new partners. For a number of good reasons this may not be a desirable course to pursue.

3. From the investors' point of view, it is easy to put money into a partnership, but extremely difficult to get it out.

4. The life of a partnership is distinctly limited; it may terminate either on the expiration of the time indicated in the articles of co-partnership, or, what is more serious, it may be ended by the death or wrongdoing of any one of the partners.

The joint-stock company is not a common form of organization in the United States. The essential differences between a joint-stock company and a corporation arise from the fact that:

1. The joint-stock company does not exist by virtue of a state charter.

2. The owners of shares are liable without limit for the debts of the company.

A corporation may be defined as a legal entity composed of a number of persons associated together for the purpose of carrying on some kind of business. These persons are stockholders who own transferable shares of the corporation. The stockholders elect a board of directors by vote of a majority of the stock; the directors in turn select the managing officers of the company. The distinguishing feature of the corporation is the authorization which it secures from the state, conferring upon it the right to exist and to do certain things directly specified in the authorization and not forbidden by it. This authorization is called a charter or sometimes a certificate of incorpora-

tion. The advantages of the corporation form of organization are:

1. Unless dissolved by the owners, or limited as to time in its original charter, it has continuous existence.

2. Because of the limited liability of the shareholders and the ready transferability of the ownership, new undertakings are readily launched, since the original investor is not committed to the bitter end because of his investment.

3. The corporation, more than any other form of organization, is in a position to raise capital for large undertakings: (a) An appeal can be made directly or indirectly to the great body of small savers who can invest moderate amounts in the securities of the corporation; (b) It can safely obligate itself for a long period of years.

4. The corporate form of organization attains greater flexibility in financing than any other form.

5. It is sometimes true that a business organized as a corporation has a better opportunity to secure mobility and efficiency in management than is provided by other types of business organization.

The objections against the corporation are that:

1. The very ease with which capital can be secured frequently leads to unjustifiable speculation and economic waste.

2. The management is frequently deprived of the close personal relationship which is essential to the most effective conduct of industry.

3. It may under some circumstances promote aggregation of capital by various forms of combination beyond the size that is industrially the most efficient.

4. It requires especial care to safeguard a corporate business against manipulation and exploitation by shrewd and unscrupulous men, who resort to methods which would not be possible under other forms of organization.

5. In the case of corporations of which the ownership is not widely distributed, serious difficulties may arise as a result of the death of an original owner; or perhaps, because of his financial difficulties, some of his stock may pass into the hands of individuals whose presence in the corporation may be highly undesirable, or perhaps even a distinct menace to the successful conduct of the business.

6. The corporation is subject to increasingly high burdens through the imposition of special taxes and fees of different sorts, which are not imposed upon other forms of business organization.

7. There is an increasing amount of public regulation and interference with corporations, which not only occasions great expense, but also results in much undesirable publicity that could perhaps be avoided under some other form of ownership.

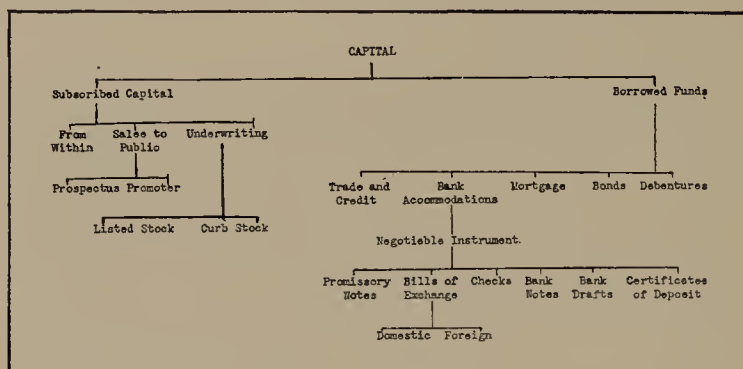
A period of rapid increase in the number of industrial corporations followed the Civil War, but the great bulk of corporate business has been organized within the last generation. From 1904-19 the

number of corporations increased from 21,097 to 91,516, or from 23 per cent to 31 per cent of all the manufacturing concerns in the country. Even with this big increase, the percentage of all manufacturing concerns in the form of corporations is not as large as might be supposed. One-fifth of such concerns are organized as partnerships, or co-operative enterprises, and the like.

Before an individual, a firm, company, or a corporation can actually engage in business, working funds or capital are necessary. The amount of money to be raised must either be supplied by a small or large number of individuals, or it must be acquired by borrowing. There is commonly considerable confusion regarding the meaning of the terms "capital," "capital stock," and "capitalization." The capital represents the physical property and valuable intangible assets that constitute the foundation of the business. The capital stock of a corporation may have no relation whatever to its capital. For example, it is possible for a concern with capital stock of only \$100,000 to have an investment value of \$1,000,000, or perhaps of practically nothing. The fact that capital stock has been issued by no means indicates that a certain amount of capital has been invested. It frequently represents only a hope, not a value. Capitalization is a word ordinarily used to refer to the sum of the outstanding stocks and funded obligations of the concern, which may

represent wholly fictitious values. Sometimes the earned surplus of a company is also in its capitalization.

On the accompanying chart we are considering capital as working capital which includes both subscribed and borrowed funds.¹ Subscribed capital is



obtained sometimes from a small group of incorporators, and when such a group advances the required funds, the corporation is generally known as a "family concern." There are a number of this type of corporation in the packing industry.

Capital is frequently obtained by sales to the public by issuing what is called a "prospectus," which is advertised in the daily newspapers and sent out in personal and circular letters to prospective purchasers. Salesmen are also often employed to

¹ Chart reproduced from *American Business Manual*, by R. H. Montgomery.

dispose of stock in this manner to the public. A third method is to place the stock on the market by listing it on the various exchanges, of which New York is foremost. The fourth and best method, and the one most generally employed for floating corporation securities, is the agency of well-established brokers or banking houses. A corporation has no facilities for marketing stocks or bonds, and so many employ a reputable firm which is engaged solely in this kind of business. Such firms have, in the course of years, established such a record for fair and honest dealing that their participation in a floatation is sufficient guarantee to their customers of its soundness.

The capital stock of corporations is sometimes increased by what are known as stock dividends. The March, 1920, decision of the United States Supreme Court that stock dividends are not to be counted as income in the hands of those who receive them has provoked a great deal of public discussion about stock dividends. By paying a stock dividend, a company, instead of distributing its earnings, has merely increased the total number of shares in which its total assets are divided; the stock-holders' aggregate equities in the property are just the same as before the distribution, though both the book value and the market value of his shares have been reduced.

When the surplus of a company is distributed in this manner, it frequently means no more than a mere bookkeeping entry. The surplus is written

down and the capital stock is increased by proportionate amount. If, for example, a stock dividend of 100 per cent should be declared, the value of the stockholder's original shares would presumably be reduced by one-half. He actually gains nothing except an additional piece of paper, though he can presumably sell his stock on the market in order to raise cash. On the other hand, the corporation has forced the stockholder to leave his share of earnings in the business.

In looking over the financial statements of many enterprises, some packing concerns among them, we see millions of dollars in the surplus account which has been accumulated from past earnings, and criticism has been offered that this represents an excessive profit in the business. In fact, so recently as the late Congress, one congressman proposed to have the government go back over the years 1917-22 and re-tax all corporations upon any surplus earnings that they may have had left after paying heavy taxes all these years, and which have not yet been distributed as dividends. Any man who recommends such a procedure as to attempt to force corporations to distribute their earnings and dividends annually is proceeding without knowledge or experience.

Surplus or earnings left in the business may be disposed of in any of the following ways:

1. To provide against years of small profits or losses, and possibly to continue dividends during such periods.

2. To maintain a strong cash position.
3. To improve the property.
4. To develop the business in new directions, such as the creation of by-product industries.

The amount of surplus which it is desirable to create through the accumulation of earnings depends on the needs of the particular business. A strong cash position is desirable for any business, but particularly so in the packing industry, which operates largely on borrowed money and therefore must have good credit. It is an industry that is handled with extension of short periods of credit, both in buying raw materials and selling finished products, and because of the relatively high ratio of volume of business to capital employed; an industry that utilizes every avenue of borrowing money to finance itself. I might mention, too, that as the federal law now stands, a tax of 25 per cent may be imposed upon the net income of a corporation in addition to the normal income tax, at the discretion of the collector of internal revenue, provided it appears that profits are permitted to accumulate beyond the reasonable needs of the business. So far as I know, no packing concern has ever had this tax imposed.

When a corporation has met its operating expenses, possibly established reserves against obligations maturing in the future, and provided for a surplus, any earnings that remain are distributed to stockholders as cash dividends. Stockholders have a right to

expect interest on their investment and some return for the risks they assume beyond those assumed by bondholders or other lenders. Well-managed corporations try as far as practicable to establish a reputation for stability and dependability of dividends. It is this rather than the amount of a particular dividend that determines the investment rating of different stocks. Adequate surplus makes for the stability of dividends.

Charges are made from time to time that some concerns dealing in the necessities of life earn too large dividends. This charge certainly cannot be brought against the packing industry. The capital, owned and borrowed, actually invested in the packing industry, according to 1919 census figures, totalled \$1,176,483,643. Production of beef, pork, lard, and mutton totalled 18,700,000,000 pounds, dressed weight. Figures compiled from the published financial reports of the five larger packers—companies whose financial reports were most readily available in *Moody's Manual* or elsewhere in published form—show that for the eight-year period beginning with 1913 and ending with 1920, a period which includes the war years, the packers averaged less than $1\frac{3}{4}$ cents per dollar of sales, or approximately 97 cents on each head of live stock slaughtered. The financial statements upon which this compilation was based were attested by certified public accountants, whose reports are everywhere accepted as being reliable and accurate.

These figures also are part of a public record, appearing in Senate Document No. 283, Sixty-seventh Congress, fourth session.

In conclusion, it is essential to remember that we live in a big country with a vast and rapidly growing population. Live stock will always be raised in the West and the large centers of industrial population will be nearer the seaboard. Our country needs large units in the packing industry to provide properly for the distribution of meat products. It needs large units to serve our present and future population and also to finance the nation's exports of meat. The United States exports \$250,000,000 worth of meat products, mostly pork. Until South America took our place a few years ago, we were also large exporters of beef. The domestic and export business of the country must be financed and proper manufacturing and distributing facilities provided if the farmer is to have a good market for his live stock. I do not see how an industry with a task like that of the packing industry can be confined to small units. The present units are not in any degree larger than the needs of the country demand.

Size is a relative term. It makes no difference how large or how small a business unit may be if only it is adapted to the work it undertakes to do. Experience in business generally has shown that units of various sizes are wholesome and that they develop and prosper side by side. The belief that big business

would eliminate competition, stifle opportunity for men of moderate means, and make for exploitation, resulted in the passage of the Sherman Anti-Trust Act of 1890. The Sherman Act embodied the idea of protecting the consuming public from exploitation and of preserving opportunity for men of small means.

The result of the first pronouncement of the Sherman Act was a period of legislation, a great amount of which was directed against the packing industry. Much of it was good, and a great deal of it was bad. The Meat Inspection Act of 1906 has proved of benefit to the industry and to the public at large. The Federal Trade Commission investigation of 1917-18 was unfair, biased, and prejudicial to the best interests of both the live-stock and packing industry. The latest legislation in the industry is the Packers and Stockyards Act. The results of it are yet to be seen, as it has not been operating long enough to justify any definite conclusion.

Business experience since the passage of the Sherman Act has shown, first, that legislation and litigation may hamper but cannot prevent growth in the size of business units when there is an economic necessity or economic pressure making for such growth. Secondly, it has shown that the development of large business units, whether by growth or combination, does not eliminate competition or prevent development and prosperity of smaller units. During

the last ten years, natural adjustment between various-sized units has been taking place in many lines of business, and each unit tends to specialize in the kind of service which it can render most advantageously to itself and to the trade it serves. Such a development is wholesome and will make for prosperity of all concerned.

The packing industry is highly competitive, principally so because the raw material, live stock, is purchased in an open market. Anybody who desires is privileged to buy in these markets. Likewise, anybody is privileged to sell. In some industries the marketing of raw materials is controlled, and consequently free competition is handicapped, but no such condition exists in packing. The only guarantee for success in the packing industry, as it should be in industry generally, is ability to provide a better product than competitors can at the same price, or a product just as good at a lower price.

That business opportunity for the man of small means should be preserved is one of the fundamental principles of our government. My grandfather and grandmother, your father and mother, maybe some of you, came to this country to seek greater opportunity. Of all nations of the earth this is the land of greatest opportunity—a place to live better, to educate our families better, and generally to preserve a higher standard of living. We have no classes in this country, and we never will have. We pay taxes to

the nation for protection and to enable it to maintain its institutions.

But government efforts are sometimes misdirected. The public often becomes alarmed over developments which, viewed from a single angle, may appear dangerous, but which contain within themselves the corrective for possible dangers. It is perhaps natural that a large part of the public, seeing only what is obvious in the present and being unable to look into the future, should seek unduly to change things by legislative fiat. Belief in the possibility of such change, and failure to make allowance for differences in capacity, energy, and ambition between individuals are the fundamental errors of socialism. Legislation, even though it may not go to the extent of socialism, which is based on either of these errors, is bound to be either destructive or futile.

Freedom and individual opportunity are deep laid in the foundation of this nation. We want and must see that there is equal financial opportunity. Even though legislation has at times made serious inroads on the principle of freedom, big business, small business, and moderate-sized business have developed and prospered side by side and have vied with each other in rendering economical service to the public.

The packing industry is an outstanding example of business units of all sizes, purveying a great variety of products and rendering a multitude of services. In the highly organized structure of the industry and

its complex system of processing and distribution, each kind of unit is finding its proper field of effort. That all this economic adjustment has been going on in the face of much hostile activity, and that the industry itself has thus promoted the public ends as well as business ends, which legislation, because it ran counter to basic principles of freedom, could not promote, is an eloquent vindication of the principle of freedom and of the soundness of our industry.





WILLIAM D. RICHARDSON

Lecture VII

SCIENCE IN THE PACKING INDUSTRY

BY

WILLIAM D. RICHARDSON



SCIENCE IN THE PACKING INDUSTRY

INTRODUCTION

In discussing the subject which has been assigned me, I shall consider in order the early origin of the packing business as related to other industries, its unscientific development in the practical way, the development of packing-house by-products and how this led to the establishment of chemical laboratories; the organization and work of the typical laboratory in respect to plant control and to research, with illustrations from both fields; and close with some remarks on future possibilities.

OLD AND NEW INDUSTRIES

The industries of the present day may be classified into two groups, depending on whether they had their origin in ancient and primitive times before science contributed in any great degree to industry, or in modern times as the direct outgrowth of scientific discovery.

When Michael Faraday in 1831 proved that an electric current could be generated in a coil of wire moving through a magnetic field, he laid the foundation of the General Electric Company and of the great electrical industry of today. When Thomas A. Edison developed the resistance filament lamp, he

founded the electric lighting industry. Joshua Ward and Dr. John Roebuck, in the seventeen hundreds, initiated the sulphuric acid industry, in many ways the starting point of the modern chemical industry. Leibig, Wöhler, and Kekule (to mention no others) laid the foundations of organic chemistry so well that Perkin at a single stroke in 1856 was able to establish the great aniline dye industry. The early work of Sir Humphrey Davy and Michael Faraday, followed by that of Castner in the nineties, started the electrolytic industry of the alkalies which now produces thousands of tons of caustic soda, chlorine, and hydrogen per day. Charles M. Hall in 1886, while yet a student at Oberlin College, developed the process by which aluminum is now made in immense quantities. Willson did the same for calcium carbide and acetylene; Acheson for carborundum and graphite, and numerous others could be mentioned. Such a plant as that of the Ford Motor Company, also the creation of a few years, may be considered as the result of the joint efforts of science and engineering, with mechanical features predominating.

These modern industries, the outgrowth of scientific research, sprang full formed from the crucible of science even as Athene sprang from the brain of Zeus. The other industries, such as metallurgy and metal working, weaving, baking, brewing, dairying, the outgrowth of the household arts, were born of sheer necessity long before the advent of scientific

investigation, and developed by the accretion of slow improvements until they were of moderate size, before modern science touched them with its magic wand and in less than two centuries transformed them into gigantic creations which could not even have been dreamed of a few centuries ago.

The packing industry originated thousands of years before the dawn of history as a household industry, along with the weaving of cloth, the making of clothing, and the building of shelters. It began in the unrecorded past when man in his evolutionary development became a hunter and converted the animals of the chase, after removing the skin by means of a rude flint, and dressing them, into meat. The skin would then be worked into leather by some simple tanning process and used for clothing, sandals, rugs, or tents. This primitive industry took a great step forward when the meat was dried or smoked over a slow-burning wood fire, or when salt was rubbed into the meat to preserve it from a time of plenty to a time of want; or when, in the colder regions of the earth, it was allowed to freeze spontaneously for the sake of preservation. Some of these methods of preservation were discovered not by the hunter himself but by the hunter's wife, for archaeologists have come to the conclusion that many of the arts and practices of primitive times were developed by the woman of the household, and it was probably she who discovered the art of cooking, or at any

rate of boiling, by dropping stones heated red hot into water contained in a tightly-woven reed basket, in which form of fireless cooker vegetables or meat were placed; and when the art of cooking developed, the last item was added to the methods of preservation of foodstuffs.

Herein, as will later be developed, lie the essentials of the packing industry as practiced today—the preparation of meat and its preservation by freezing, by cooking, by salting, by smoking, and by drying. But the appetite of primitive man was probably more intense or voracious than that of his modern representative, and this may have brought about a distinction between the ancient and the modern meat industry. In the modern industry, by-products occupy a prominent place; in ancient times (one is reminded of the story of the boys, the apple, and the core) there were probably no by-products beyond the hide.

The tendency of civilization has been away from the wild life of the hunter to that of the nomad moving from pasture to pasture with his flocks and herds; from the nomad to the farmer who tilled the soil for crops and also kept domesticated animals, and so on to fixed communities of dense population; but it was a long step, which required a great period of time, from the career of man as a hunter to the stage wherein he domesticated certain wild animals such as the sheep and goat, the ox, the horse, and the pig, the yak,

the camel, the elephant, and the dog; first, perhaps, for furnishing food and clothing, for beasts of burden and communication, as aids in the chase, or merely as pets and friendly companions. In all probability, the domestication of animals began when the hunter brought home, as a living trophy for his children to play with, a whelp, a cub, a puppy, or a lamb. The domestication of animals and the establishment of herds and flocks was an essential though very early step necessary for the later development of packing-houses.

MECHANICAL AND CHEMICAL INDUSTRIES

Industries may be classified in another way than according to their origin: they may be classified as mechanical industries and as chemical industries, depending on whether the materials which they work up are altered in form only, as in the molding, weaving, and woodworking industries, or in substance and composition, as in the chemical industries proper, the metallurgical industries, and in glass making, cement making, ceramics, brewing, and others. The packing industry presents a dual character, being mechanical in so far as the mere form of its raw material is changed, and chemical in so far as the chemical nature of its products is changed. The chemical side of the industry is connected more particularly with the by-products as, for example, when oils and fats are manufactured into soap, hides

into leather, and the white connective tissue of bone and skin into gelatin or glue.

It was perhaps natural, since the industry had this dual character, that the mechanical side should be developed first and the chemical side last. Mr. Weld has pointed out in a previous lecture how the packing-houses developed from the slaughter house of the early days in order to handle by modern methods the immense live-stock output of the Mississippi Valley; and Mr. Cushman has described the mechanical appliances developed by and used in the industry for handling the product in an expeditious and sanitary manner. The old era of the animal products industry passed away without notice and the new era began without ceremony. That era witnessed the passing of the small abattoir with its wasteful and insanitary methods and the establishment of the packing-house on a scale adequate to handle the live stock of the Central West and to vend the multifarious products and by-products of the industry in the markets of the world. The efficiency, sanitation, and commercial economy of the large establishments became proverbial. Mechanical refrigeration was generally substituted for natural. The refrigerator car came into common use, and mechanical methods were highly developed and gradually extended into all departments. During this period the aim was to utilize in some way all parts of the animal body, not necessarily in the best way—the by-product industry

developed too fast for that—but at any rate in a manner which would yield profitable products. This point marks off one period of development—everything but the bleat, squeal, and moo (as the common saying is) were utilized somehow, some way, but not necessarily for the highest use or in the most economical way.

STABILIZING A PERISHABLE PRODUCT

The introduction of mechanical refrigeration into the packing industry and the common use of the refrigerator car in transporting meat and other products of the packing-house, had the effect of transforming an otherwise perishable product into one of partial stability. Handling by this means in no way changed the essential perishability of the products, but, within limits, so long as they could be and were kept at low temperatures, their perishability was so reduced that they could readily be moved from centers of production to centers of consumption like any other product or commodity.

The revolutionary change resulting from the introduction of these improvements into the industry, making it at once independent of seasons and of external conditions generally, can best be appreciated by contrasting present-day operations with those of the old-time slaughter house, from which the product was moved to market and sold during the morning hours of the same day, or with ordinary farm practice,

which was so circumscribed by external conditions that hogs could be slaughtered for food only in the late fall or winter season.

Thus, the first great problem of the packing industry was solved: all-year-around operation under mechanical refrigeration and the transportation in chilled condition of the main products of the business. But this solution was only partial, for the problems connected with by-products were not thereby taken care of, nor could they be taken care of all at once. The business was growing with enormous rapidity in the eighties and nineties of the last century.

BY-PRODUCTS

The edible organs were separated from the rest of the offal and sold for food along with the meat. The remainder was rendered in tanks for the recovery of lard or tallow, as the case might be. The tankage was pressed and the lard and tallow barreled. There grew up around the central packing plants a group of satellite industries, separately owned and managed, making use of the unfinished by-products of the plants. There were lard refineries which took the ununiform steam-rendered lard of the packing plant and refined and bleached it for sale on the open market. There were butterine factories which made use of neutral lard and oleo oil from the packing plant for the manufacture of oleomargarine. Various grades of tallow were purchased by soap factories

both nearby and distant. There were fertilizer plants which carted off the pressed tankage and raw or pressed blood, which they dried and sold as such or manufactured into mixed fertilizer. There were glue works which manufactured glue from bones, sinews, and various other materials obtained from the packing-houses. One by one, the functions of these satellite industries were taken over by the packing-houses, so that in the end the packing-house was a self-contained institution, working up into finished by-products all of the raw materials formerly sold to outsiders. One by one, the smaller industries which depended upon the packing-houses for their raw material disappeared. This course of events is important in studying the application of science in the packing-house industry, because it was these by-product industries and not the packing-houses themselves which were the first to employ chemists and to establish chemical laboratories. This was a natural and logical development.

THE CONTRIBUTIONS OF SCIENCE

Although all the sciences, including the one under discussion, contribute to modern industries, some contribute more than others and in ways that are more direct. For example, the great science of astronomy keeps time for the industries, but it is not often that one stops to reflect that such is the case. Geology has its word to say about water supply and founda-

tions of buildings, although we may not often think about it. Biology and medicine play their parts; physics affords the basis of engineering, but the most obvious application of science and the most important and direct of all comes through the medium of the chemical laboratory. Hence, in the following discussion, the chemist holds the center of the stage, which, you may imagine, is set with retorts, test tubes, stills, pipettes, burettes, and other paraphernalia of the chemist's workshop. Science in the packing-house has become synonymous with the science of chemistry.

CHEMISTRY OF THE ANIMAL BODY

The raw material upon which science, and particularly chemistry, does its work in the packing-house industry is the most complicated physico-chemical entity in the world. I refer to the animal body. The old time-worn phrase "fearfully and wonderfully made" only meagerly expresses the physical and chemical profundity and delicacy of the animal organism. To be sure, in the packing industry only a beginning is made in unravelling the complexities established by the living cell. For the most part, the body is handled in a gross and piecemeal way, and it is only in a few instances, as, for example, in the preparation of the extract of a ductless gland, adrenalin, or thyroxin, that chemistry at its full is applied; but even in its limited applications

the complexity of the organic cell is felt, as in the rendering of fats, the preparation of blood albumen, the manufacture of gelatin, or of pepsin. It may be the proteolytic power of pepsin, or the coagulation point of albumen, or the relation of viscosity or jelly strength of gelatin to hydrogen ion concentration which awaken the astonishment of the investigator, and these are but minor points amid a host of chemical and physico-chemical wonders connected with the dead building stones of the organic body. As the applications of chemistry increase, as refinements in manufacturing processes accrue, details such as these will appear as nothing in the midst of those later complexities. Time and the accumulation and co-ordination of knowledge are requisite for such developments. In the meantime, chemistry will have large and increasing applications in connection with the manufacture and utilization of by-products, although small compared with the possibilities.

THE FIRST CHEMICAL LABORATORIES

The packing-houses were not slow to follow the examples set by the by-products industries. In the early nineties of the last century, all of the larger firms began to employ chemists, at first employing a single individual, afterward perhaps employing a laboratory "devil" to assist him.

The laboratory of those days usually consisted of one small room and a sink, together with a chemical

balance and a few pieces of glass apparatus and Bunsen burners; but in some cases the laboratory was a mere abstraction. It did not exist in reality. There was the chemist and a desk for him to sit by, but nothing more.

Thus, the chemist came into the modern packing industry, which had its origin far back in the beginning of things, when the early ancestors of man as we know him, brought home the animal which he had killed in the chase, skinned it with a sharp piece of flint, and dressed it.

WHAT THE CHEMIST FOUND

Let us for a moment glance at the industry as it existed in the early nineties, through the eyes of a scientifically trained chemist who came to take charge of a rudimentary laboratory and to aid the industry by the application of science to it. He saw a great and flourishing plant, growing rapidly, partly equipped with chill rooms and freezers controlled by mechanical refrigeration, and partly with chill rooms cooled by means of natural ice. The old farm practice of seasonal slaughter of hogs still held over from earlier days, and it was the custom to increase the output of pork by slaughtering in the late fall and winter when artificial refrigeration was unnecessary. The refrigerator car had been developed and was being built in increasing numbers. Mechanical appliances were being developed almost day by day. Special mention should be made of

the scraper and the moving chain on the hog killing floor. Curing processes were still managed by rule of thumb methods, although an effort had been made to standardize and understand them. Hides were handled by the time-honored method of dry-salting; sheep skins by empirical methods developed in the tanneries. Kettle-rendering and steam-rendering processes were in use for the recovery of lard and tallow, while bleaching and refining methods were just developing and were not in universal use. Tankage and blood were handled by pressing and drying; bones were utilized only in part for gelatin and glue. Much of the bone output was still sold as raw bone meal—a most unfortunate waste of gelatin and glue raw material, which has not yet been entirely corrected. The commercial fertilizer industry had hardly begun, for the packing-house and even the animal fertilizer branch was but partly developed. It was clearly seen that a great future in by-products was to be expected, but how this future was to be realized, and what by-products were the most important, and how they were to be worked to best advantage, were unanswered questions. In those days, some owners and managers endeavored to go to the extreme, entering into branches which were not a logical part or development of the packing industry in the endeavor to see how far side lines could be developed. Others were more conservative and proceeded more slowly in the development of by-

products. The soap factory was not then considered a necessary part or adjunct of the business, and the vegetable oil industry had not joined hands with animal fats. Margarine was being manufactured in a small way.

The main efforts had been placed where they belonged: on the main products of the industry; and the by-product branches had been developed in a somewhat haphazard fashion by accretion, addition, or the chance acquirement of an operating man skilled in a particular branch. Much of the practice was good, sound, practical, as though it had been established by scientific methods, but much of it was thoroughly unsound and irrational, and could have been corrected at the start by a reasonable application of scientific methods. The corrective methods were applied later and are still being applied.

APPLYING SCIENCE TO AN OLD INDUSTRY

It is far more difficult to apply scientific methods to an old industry like the packing industry than to a new one which is the creation of modern science, and having that origin and resting on that foundation, in itself essentially scientific. In the old industries, the traditions of old methods of operation, the inertia of rule of thumb processes, and the conservatism of the operating men are difficult to overcome. Occasionally, although not usually, men of scientific vision are found among so-called practical men.

This is the result of a natural bent or tendency, but for the most part the scientific point of view is difficult for the operating man to attain.

FALLACIES CONNECTED WITH THE CHILLING
AND FREEZING OF MEAT PRODUCTS

Some of the most deep-seated and pertinacious obsessions of the packing industry were connected with the chilling and freezing of meat. One of these had to do with a certain philosophical abstraction which was known as "animal heat." This "animal heat" was to the packing-house mind something different and apart from any other sort of heat and had to be removed by special means before one could proceed with direct chilling or freezing. If meat were placed in a chill room or into pickle or into a freezer before the "animal heat" was removed, the meat would spoil. Hogs must be allowed to remain on the hanging floor for a certain period before being run into the cooler, so that the "animal heat" might have a sufficient time to escape. The same idea was applied to poultry. The birds were duly placed on racks before being chilled or frozen so as to allow the mysterious caloric derived from the living processes to make its way into the atmosphere. The scrutinizing eye of science has since told the practical men that all these ideas are fallacious, that the so-called "shelling over," due to superficial freezing when meat is run into a freezer, is not a

detriment but a benefit so far as preservation and keeping qualities are concerned, and gradually the practice in regard to these matters has changed entirely. All but a few of the old-time, so-called practical men now realize that the sooner the product is chilled or frozen the better its keeping qualities, will be.

MYSTERIES OF HAM CURING

It was perhaps natural that during the unscientific period of development in the packing industry that along with the good and sound practices developed, there was also much which was bad. Many of the bad practices centered in the curing of pork products. The fads and foibles and superstitions, notions and prejudices, uncertainties and bad practices which grew up and took rank alongside of a very excellent and logical development, may be considered now with a smile, but they cost the industry hundreds of thousands of dollars and could have been remedied much earlier than they were by the application of scientific ideas. The reason for the notions and superstitions was no different in this case from others and was due merely to a lack of definite knowledge or lack of a clear understanding of what the curing process involved. It was then a rule-of-thumb process developed by so-called practical men, who are often very far from practical in the real sense of the word.

The curing department of those times was a secret department presided over by an "expert," so called,

who kept his formulas in a little book in his inside coat pocket and his secret ingredients in a room under lock and key. No alchemist of the Middle Ages was more equivocal and obscure in discussing the mysteries of transmutation than our hero of the curing cellar in obfuscating the nature and procedure in salting and smoking meats. His methods were tinged with magic but his results were often anything but magical.

Many strange and unexplained things happened in the curing process as applied to hams and bacon. Meat became spoiled or sour at times and did not spoil or become sour at other times. One vat put down on a certain date might contain spoiled meat while other vats put down on the same date would come out sweet. There were veritable epidemics of spoilage at times and even recurrent epidemics. So-called ropy pickle made its appearance, thick and viscous like mucilage. If these things had occurred in the old days of witchcraft, the curing cellars would have been declared bewitched and a few victims probably would have been burned at the stake. Instead of the ordeal and cure by fire as it would have been applied in the olden days to human witches, the method adopted by the bacteriologist was, indeed, a baptism of fire, but in the way of heat sterilization and disinfection of curing vats, pickle, and various implements used in handling the meat.

The mysterious occurrences enumerated, so upsetting in the handling of the curing process and causing so much damage and spoilage in the meat, were due to microscopic organisms which sometimes developed in great numbers in the curing vats but which readily succumbed to heat and sanitation.

In due time, the secret methods of managing curing processes, together with secret formulas and secretive foremen, were subjected to the white light of science. One by one, exact methods of procedure and control were worked out until at the present time spoilage of meats in cure has been reduced to an almost negligible quantity.

THE PECULIARITIES OF SALT

The chemist knows that sodium chloride or common salt, wherever produced or whatever the source, provided analysis shows equal purity between different samples, will have the same properties and the same ability to cure meats. The practical, old-time curing man, on the other hand, recognized no such ideas or limitations. He had proved beyond any reasonable doubt that for the proper curing of pork hams or bacon or beef hams, as the case might be, it was necessary that salt must be derived from or imported from a certain mine or district or city, no matter what the analysis might be. Liverpool salt was different from Turk's Island salt or Avery

Island salt or Michigan salt or Kansas salt, or salt from some other source. While open to conviction on these points, he had in a measure the attitude of the Irishman who would like d— well to meet the man who could convince him to the contrary. It required many years of experiment and persuasion to convince these old-timers that, given equivalent purity and grain, one kind of salt was as good as another for curing purposes. Although the former superstition has for the most part been eradicated, vestiges of it are still discernible here and there. The ghost still walks although less frequently than before. For the most part, however, price and analysis govern the kind of salt used for all purposes.

ATTITUDE OF MANAGERS AND PRACTICAL MEN

The mere introduction of the chemist into the industry did not by any means place it on a scientific basis. There were many difficulties in the way of the transformation which was to come later and is even now only beginning to be realized. Many of the managers and practical men in the industry had an entire lack of understanding and a deep-seated mistrust of scientific aims and methods, so that when an attempt to apply science to the industry was made, the efforts were vain and unproductive, not because of lack of intelligence on the part of the chemist but on account of the lack of understanding and appreciation on the part of the management and

the operating men in the industry. In spite of the fact that attention was called to errors, the errors persisted. In spite of tests showing the fallacies of certain bad practices, the practices continued. The minds of the operating men of those days were not receptive of new ideas. Conservatism prevented progress. There were other large difficulties, all having to do with a young and rapidly growing industry struggling with its destiny, with imperfect organizations, lack of facilities, finances and labor. The road of the scientific investigator who would improve old processes was steep and rough. But in the fullness of time the practical operating men and managers have come to have a better appreciation of the scientific point of view, and the men of science to have a better understanding of the views of practical men. Indeed, many practical operating men of this day can discuss with fluency and understanding such matters as titers, iodine numbers, fatty acids, rancidity, oxidation, hydrogenation, proteins, pH values, bacteria counts, centigrade degrees, availability of potash, normal solutions, and many other recondite things pertaining to the laboratory.

SCIENCE BOTH CORRECTIVE AND CREATIVE

The examples cited are sufficient to indicate the errors into which an industry may be led when developed empirically, along practical lines, by practical

men, without the aid of scientific methods. Such blunders and bad practices can readily be corrected by the application of scientific methods, provided the management is sufficiently intelligent to appreciate the scientific viewpoint, but corrective results such as these are, after all, of a negative rather than a positive sort.

I propose from now on to deal with the creative side of science and its application in the packing industry to the control of supplies, raw materials, manufacturing processes and finished products, and to the investigation, development, and invention of new processes and products. In these fields lies its greatest importance and usefulness.

THE EARLY PACKING-HOUSE CHEMIST

The early packing-house chemist was a man of all work, and the chemical laboratories under the old order were organizations with mixed functions, partly analytical, partly research, and partly operative. One chemist might be called upon to perform all sorts of work from sampling fertilizer or tallow to operating a part of the plant, such as the beef extract and pharmaceutical departments. For many years, routine analytical work predominated, and it has only been in recent years that definitely and separately organized research laboratories have been introduced into the industry. The development and differentiation of work in the chemical laboratory was a matter

which required many years and much arranging and rearranging of the organization.

GENERAL ORGANIZATION OF THE MODERN LABORATORY

The organization of the modern laboratory consists of two principal divisions: the analytical laboratory and the research laboratory. The analytical laboratory is divided into several departments corresponding to the principal departments of the plant which require analytical work. These are as follows:

1. Meat curing, hams and bacon, sausage, etc.

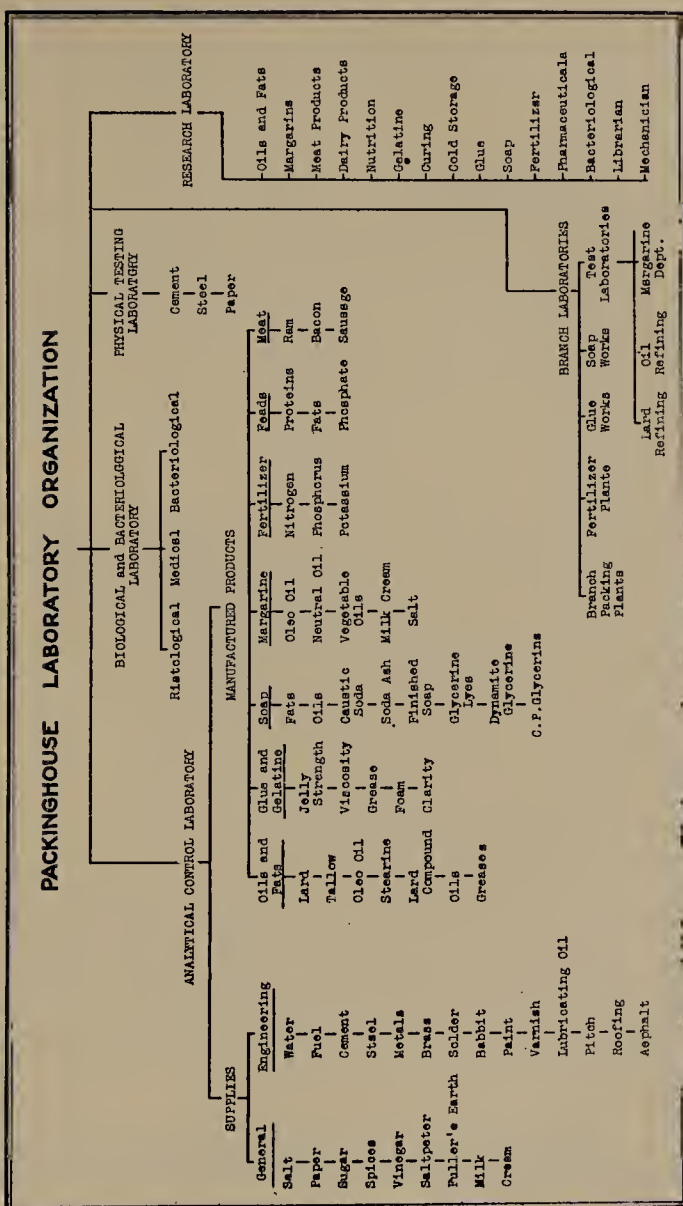
This department handles analyses of raw materials of curing and pickle, such as salt, sugar and saltpeter, vinegar, etc., and makes analyses of meats, both in fresh condition and at various stages during the cure, in order that a proper control of the curing processes may be maintained and a uniform product assured. It also makes analyses of the finished hams, bacon, sausage, etc.

2. Fats and oils.

This department makes all analyses required on production and shipping samples of fats and oils, lard, tallow, coconut oil, cottonseed oil, and other oils and fats used in the margarine industry, and on raw materials for the soap industry.

3. Soap and glycerine.

Analyses of raw materials and supplies for the soap factory, caustic soda, soda ash, salt, oils and tallows, fatty acids, cottonseed foets, essential oils for perfumes, soap in process, finished soap, soap powders, soap flakes, and competitors' soaps. For the glycerine refinery, samples of



glycerine lyes and of crude, dynamite, and C. P. glycerine. When the soap factory is located away from the main packing plant, an independent laboratory organization is usually maintained.

4. Glue and gelatin.

In this department are made all analyses connected with the raw materials of manufacture, glue and gelatin liquors, and the finished product. The exigencies of modern trade demand many more and much more careful analyses and tests than were made formerly. At the present time the methods of testing are undergoing thorough revision and more elaborate and more precise methods are being developed.

5. Fertilizers.

The organic residues of the industry, such as dry blood tankage and bone, are analyzed in this department; and also the raw materials and manufactured products of the mixed fertilizer industry, such as acid phosphate, potash, nitrate of soda, sulphate of ammonia, and various complete fertilizers for shipment. It is customary also to maintain branch laboratories at commercial fertilizer plants.

6. Animal feeds.

The amount of material from the packing industries going into the fertilizer trade during the past ten or fifteen years has become less and less, with a corresponding increase of that going into animal feed production, so that at the present time comparatively little of the organic residues, such as blood, meat scrap, cracklings, and tankage, are used for fertilizer. In the future, still less will be so used; consequently, the control work on animal feeds takes a prominent place in the analytical laboratory.

7. Engineering supplies.

A large amount of work is done in this department on water supply for general packing-house plants and for boiler

purposes, on the analysis of coal and other fuels, as well as on paints, varnishes, iron and steel, various alloys, such as brass, babbitt and solder, and the general supplies and materials of engineering.

8. General supplies.

All supplies purchased in the packing industry are bought on analysis or test and are carefully analyzed and examined in the laboratory for grade or quality.

At the present time the research laboratories of the packing industry are organized under the same chief chemist who has charge of the analytical and control laboratories, and, as a rule, there is some transfer of men from one department to another, depending on the amount of work of a given sort required at a certain time. The tendency is, however, toward entirely separate organizations, and probably within the next few years the divorcement of the research organization from the routine analytical organization will be accomplished.

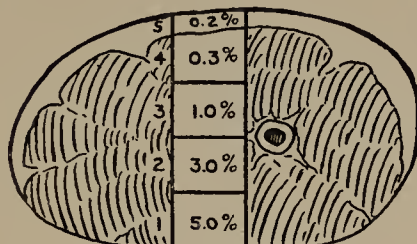
The research laboratory is organized in the same general way as the analytical laboratory; that is, by departments corresponding to the principal operating departments of the plant which require research work. These branches are: meats and curing, dairy products, fats and oils, soap and glycerine, glue and gelatin, animal and commercial fertilizers, animal feeds, animal glands, and pharmaceutical products. There may be, in addition, a department of nutrition and a laboratory for bacteriological work.

THE PURPOSE AND APPLICATION OF CONTROL
ANALYSES

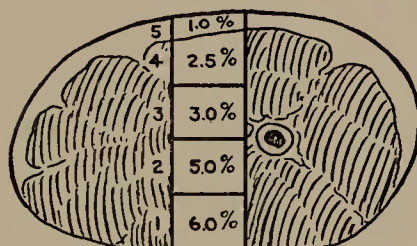
An illustration of the application of control analyses might be taken from any department of the packing plant, such as the lard refinery, the soap factory, the fertilizer works or the glue plant, but an example from the curing of hams will serve as well as any. As is well-known, ordinary sweet pickle contains a considerable percentage of salt, a smaller quantity of sugar, and a very small amount of salt-peter. In order to simplify the discussion, we shall consider only penetration of the salt into the ham. This penetration occurs by what is known as osmosis and takes place almost entirely from the face or lean side of the ham, since the fat layer is very nearly impervious to both water and salt. It is natural, therefore, that after the ham has been in pickle for a short time, the outer lean layer will contain considerable salt and the interior layer next to the fat little or none. Gradually, the amount entering the ham increases, so that for a medium weight ham at the end of perhaps 60 days there will be some 6 per cent of salt in the face layer and perhaps only 2 or 3 per cent in the portion next to the fat. Now, a suitable amount of salt for a mild cured ham is about 3 to 4 per cent and the more uniformly distributed it is the better; hence after coming out of pickle the ham is soaked in water for a certain length of time to reduce the amount of salt in the outer portions.

ANALYTICAL CONTROL OF HAM CURING

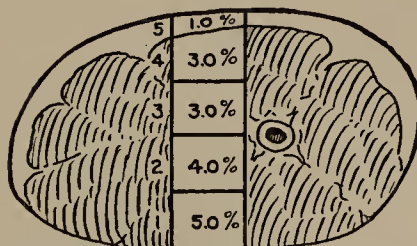
SHOWING SECTIONS SAMPLED
AND TYPICAL ANALYSIS FOR SALT



PARTLY CURED



FULLY CURED



AFTER SOAKING AND SMOKING

It can readily be seen what an important part chemical analysis plays in a process of this sort and how necessary for a control of the process it is to know at a given time how much salt there is in each layer of meat from the outside to the inside. The diagram on page 273 show the method of sampling a ham and typical analyses for salt in the different layers in an early stage of cure, when fully cured, and after soaking in fresh water and smoking. There are other factors, too, to be taken into consideration, such as the leanness or fatness of the ham and various details which it is not necessary to consider here. By making many analyses at different stages of curing, the large packinghouse is able to turn out cured hams of a uniformity unattainable before the advent of the chemical laboratory and before pork products were handled in large quantities. The modern ham turned out under the guidance of chemical laboratory control is a standardized product of great uniformity. The myth of the old country-cured ham is rapidly passing away. That product, which was generally over-salted, not uniformly salted, over-dried, and over-smoked, could not compare in delicacy of flavor or succulence with the modern packing-house product.

CONTROLLING AND STANDARDIZING FERTILIZERS,
ANIMAL FEEDS, GLUE AND GELATIN,
AND OTHER BY-PRODUCTS

The analyses that are regularly made, as described in the case of hams, also are applied to bacon and

other cured meats. In fact, there are no products of the packing-house which are not analyzed regularly or occasionally. The occasional analyses are made on fresh beef and pork and other main products, but regular control analyses and tests are made on all by-products, such as fertilizers, animal feeds, glue and gelatin, margarine, lard and tallow, soap and glycerine, so as to insure standardized products and uniformity.

In a large packing-house laboratory, from 200 to 500 samples of all sorts may be handled in a single day. The superintendent and foreman every day receive analysis sheets showing the composition of the various by-products, for guidance in operation, classification, and filling orders. Without laboratory control of this sort, the by-products departments could not operate satisfactorily for a single day.

To the analyst, the application of science to industry is not always seen in as rosy a light as it appears to the philosopher considering the subject. In order to express the monotony of making routine analyses, the chemist is wont to say, "Life is just one d -- analysis after another."

BRANCH LABORATORIES AND TEST ROOMS

Branch laboratories are maintained at all the principal packing-houses, fertilizer works, glue factories, soap works, etc. These are generally administered under the technical direction of the central

laboratory, although their local operation is directed by the operating superintendent of the plant; sometimes, however, they are organized independently. Frequently, or usually, the chemists and assistants for these laboratories are trained in the central laboratory and sent out from there, and a regular system of inspection and a definite means of checking analyses are maintained in order to insure uniformity of results at all points.

Test rooms are maintained in various departments, such as lard refineries and butterine factories, oil refineries, etc., for the purpose of making routine tests and determinations such as can be managed by a person of moderate skill and training. These also are under the general supervision of the central laboratory.

THE LABORATORY ENERGIZES THE PLANT

The scientific man in industry has been compared to the exciter on a dynamo electric machine. Without the exciter, the driving power of the dynamo is wanting. Without the small exciting current activating the electro-magnets, the larger current on the principal circuit does not flow. The analogy may not be perfect. Certainly in the absence of laboratory control and research, plant operations do not cease altogether, but there can be no question about the potency of the energizing current arising from a properly organized chemical laboratory to

stimulate and promote both old and new plant operations.

KEEPING THE LABORATORY UP

But if the laboratory stimulates the plant, it also has much work to do in keeping fit itself. Within the laboratory organization there is a continuous effort to improve old analytical methods and to devise new ones in order to deliver to the operating departments more accurate results in a shorter space of time. To this end, new experiments for testing purposes and new methods of analysis are constantly being devised and experimented with. The laboratory is not less critical of its own imperfections than it is of full scale plant operations when these are not scientific and efficient.

THE NATURE AND PURPOSES OF RESEARCH

We often hear the expression used that someone or other stumbles on a great discovery or makes a great invention by chance. This is seldom the case. Most so-called discoveries and great inventions are the result of careful training, long study, and continued experimentation. Even assuming that chance, so called, plays a part in great discoveries, it should be noted that chance in observation favors the prepared mind. The child has eyes to see but not the prepared mind; hence, sees and understands but little. The man with the untrained mind, having

eyes, sees not, or at best sees only the superficial aspect of things.

The research laboratory has three principal purposes or functions:

1. To improve old processes and products.
2. To invent new processes and products.
3. To assimilate inventions made by others outside the organization and adapt and apply them to the industry.

Of the three the last is perhaps the least obvious, but at the same time one of the most important uses of the research staff.

The improvement of processes undoubtedly occupies the greater amount of time of the research laboratory in an industry like the packing industry, whose principal processes were established before scientific thought was systematically applied. It is not too much to say that there is scarcely a single process in the entire industry which, if carefully examined, is not susceptible of improvement through the application of chemical knowledge. Naturally, many processes in the industry are of a mechanical nature and all of them involve the use of machinery and equipment, so that, in working scientific improvement of a process, it is necessary that the chemical force maintain close affiliations with the engineers. A judicious combination of chemical and engineering knowledge will solve all of the difficulties of operation which are humanly solvable in our industry. As an

example, the revolutionary changes which are even now taking place in methods for rendering fats are the results of just such a combined effort and will result not only in cheaper production and simplified operation but also in an improved product with better keeping qualities than the old.

NEW PROCESSES AND PRODUCTS

It is not often that inventions which are entirely new are developed and applied. Although the old saying that there is nothing new under the sun is hardly to be taken in a literal sense, most inventions are of the nature of improvements or additions and are developed in the way of sequences, one improvement following after another. But the hydrogenation process, which was developed in the period from 1900 to 1915, may be considered entirely new. This process, having its origin in the work of Sabatier and Senderens, who, making use of a nickel catalyst, were enabled to hydrogenize or add hydrogen to various organic compounds, particularly gases, was applied by Norman to oils and fats, and was developed on a large scale by Crossfields in England and by various firms in the United States. The essential features of the process are that when hydrogen is applied to a liquid oil in the presence of an active nickel catalyst, the oil combines chemically with the hydrogen to form a so-called saturated compound. The saturated or hydrogenized fats are solid or semi-

solid substances, the unsaturated or unhydrogenized are liquids; hence, by the process liquid oils are converted to semi-solid or solid fats of lard-like, tallow-like, or stearine-like consistency. By the application of this process, a new type of lard compound came into existence and a new source of raw material for the soap industry became available. Incidentally, the hydrogenation process acts as a deodorizing process as well, so that fish and whale oils under the treatment become quite odorless and bland.

Recently, the reverse of this process has been experimented with in an endeavor to convert saturated and half-saturated fats into unsaturated drying oils of the type of linseed oil.

FROM LABORATORY TO PLANT OPERATIONS

When an improvement or a new process or a new product has been developed in the research laboratory, it is customary to construct a small-scale working unit and to begin manufacturing operations, in order to ascertain the difficulties and possibilities of the innovation and to work out construction details before proceeding with the full-size installation. The laboratory usually designs or designates the necessary machinery and supervises the erection and operation of the full-scale unit and continues the operation and control until all details are sufficiently established and standardized so that the plant can be turned over to the regular operating

departments. Laboratory control and general supervision may continue for an indefinite period, depending on the ease of operation or the difficulties encountered. During this period the closest co-operation between the scientific and operating departments is not only desirable but necessary for the benefit of the business. Without such co-operation, progress is uncertain; with it, success in new manufacturing enterprises is assured. This sort of co-operation is an infallible test of the progressiveness of a plant organization. It is characteristic of up-to-date management; it is absent from old-fashioned plants and reactionary managements.

ASSIMILATION OF OUTSIDE KNOWLEDGE

The third function of the Research Laboratory, namely, to assimilate the inventions made by others and adapt them to the business, is of great importance. No day passes during which one or several inventions or processes are not offered to the packer. Most of these processes and products are worthless. Occasionally one is presented of great merit. How is the industry to know the good from the bad? One method would be to try them all and thus separate the sheep from the goats; but with a highly trained research staff it is possible in the beginning to say which of those offered are likely to have some merit and which on the face of matters are undoubtedly useless or even fraudulent in character. In order to

avoid the possibility of passing something worth while, it is often the case that a few of the worthless ones are given a trial against the protests of the scientific staff. In my own experience, however, I have never known a single instance wherein the scientific staff pronounced a process or product worthless that it did not prove so in the sequel. Many of the worthless or useless types of inventions make use of electricity in some way or another, so much so that almost any invention which claims to "do it by electricity" should be particularly scrutinized. The idea of "doing things by electricity" has caught the popular imagination and has become, in consequence, a selling point made use of by unscrupulous promoters.

In order to keep informed of scientific progress, the research laboratory of a large establishment must keep in close touch with the literature of science and invention as embodied in various textbooks and technical works, current scientific literature in the form of periodicals, and the patent literature of the United States and foreign countries. The volume of scientific literature has become so enormous that practically all large research establishments of the present day maintain a considerable scientific library and a competent librarian, usually himself a man of scientific training as well as library training. The librarian not only keeps in touch with current progress as indicated by the literature, but also makes reference lists and searches the general and patent literature

for all reference sources covering any particular point, process, or product which may be under investigation. Searches of this sort are also of great importance prior to the filing of patent applications covering processes or products developed in the research laboratory.

STUDIES OF FROZEN MEATS

A few typical investigations made by research laboratories in the packing industry will be described.

Of the four general methods for the preservation of foods, low temperatures, heat sterilization, salting processes, and desiccation, all but the last are in general and extensive use in the meat-packing industry. Of them all, the application of cold is the most satisfactory, because by this method the product is kept most nearly in its natural condition and without addition or subtraction of substance. Cold storage divides itself into two procedures: the preservation of foods above the freezing point and their preservation in the solid, frozen condition. Both have been greatly aided and improved by intensive scientific study during the past twenty years, but there are many details remaining for investigation.

There was a time in the early nineteen hundreds when severe criticism was directed against the preservation of meat by freezing. Certain food officials of the government, men in high positions, undertook to say, and endeavored to prove by scientific investigation, that deterioration began in frozen

meat products, such as beef and poultry, as soon as they were placed in the freezer. The practical men in the packing industry knew that the position of the food officials in question was unfounded, but it remained for the chemists of the industry to show by a long series of investigations that no essential change in composition occurred in frozen meat products, even when stored for a very long period of time. In other words, it was demonstrated beyond a reasonable doubt that meat in the solid, frozen condition, and unexposed to air, would keep for an indefinite period of time. In the ordinary course of events, the period during which meat is kept in the frozen condition amounts to a few months only or, at most, to less than one year, and for short periods of time such as these no perceptible change occurs. By the investigations conducted in the laboratories of the packing industry, the food officials were persuaded of their error, and the campaign which had been begun against the practice of freezing meat was abandoned. It is now universally accepted that food products can be held in the solid, frozen condition without essential deterioration for practically unlimited periods of time. The importance of this fact to the nation, in times of peace as well as of war, is beyond compute.

THE BLEACHING AND REFINING OF OILS AND FATS

Much investigation has been done in the research laboratories of the industry on the refining and bleach-

ing of oils and fats. The handling of these materials by modern methods dates back only some thirty years, yet even in that brief space of time it is difficult to trace the history of their development. It is difficult, for example, to determine who first applied caustic soda refining to vegetable and animal oils, who introduced bleaching by fuller's earth into the industry, and who applied and developed steam deodorizing.

With some of these processes, particularly the application of fuller's earth and deodorizing by steam, the name of Mr. W. B. Allbright is associated during the period that he was chief chemist, and later superintendent and manager, of the N. K. Fairbank Company. In fact, many, if not most, of the processes now in use for handling and refining lard and the vegetable oils are due to this pioneer chemist. Other processes in the oils and fats branch of the business are due to Dr. David Wesson, also formerly associated with the N. K. Fairbank Company, later and at present Technical Director of the Southern Cotton Oil Company.

ORGANOTHERAPEUTIC PRODUCTS AND THE ENZYMES

Organotherapy is that branch of therapeutics which applies the organs, glands, and the active principles thereof to the prevention and cure of disease, the maintaining of normality in the human body, and, in general, the alleviation of the ills to which the flesh is heir. The hopes for organotherapy have risen

and fallen during recent years with the discovery of a new physiological action, the isolation and the identification of an active principle, and, on the other hand, the failure to discover, or the failure of preparations and extracts to produce uniform results in all cases. Yet out of the apparently contradictory evidence as to the value of the ductless glands and other physiologically active parts of the body has come the firm conviction that systematic study and experiment will develop from these sources not only valuable remedial agents, but a fund of knowledge of the greatest importance to the sciences of medicine, organic chemistry, and physiology.

The packing plants, being the largest producers of the raw materials for this class of medicinals, naturally have been interested from the beginning in the development of manufacture and knowledge of animal glands and extracts, and their research chemists have devoted much time and study to the subject.

Adrenalin, the active principle of the suprarenal body, is now a standard preparation, and thyroxin from the thyroid gland has come upon the market more recently, but these are the only substances which have been identified with reasonable certainty.

The entire subject of gland therapy has been recently reviewed and discussed extensively both by physicians and laymen, owing to the publicity attending the interstitial tissue operation and the dis-

coveries of Drs. Banting and Best, of Toronto, who have prepared for the first time an active extract of the island tissue of the pancreas for the cure of diabetes.

Passing over the great need for further knowledge of the physiological action of the active principles and extracts, we are of the opinion that one of the primary manufacturing needs is methods of standardization. Standardized products are the primary requisites. Products of good keeping qualities also are required, since standardization would be well-nigh useless if the product did not maintain its original standard for a considerable period of time. Perfect standardization can be attained only with the separation and identification of the active substances. At the present time, most of the products are manufactured in the form of dry powders.

The manufacture of concentrated preparations of the digestive ferments, such as pepsin from the stomach and pancreatin from the pancreas, is still carried out on a moderate scale, but there is room for great improvement here, both in methods of preparation and of application, a rich field for the research chemist.

The entire subject is so vastly complicated and difficult that progress certainly will be slow. Although the manufacture of organotherapeutic products can never be a large part of the packing industry, from the standpoints of chemistry, medicine,

and humanity this branch is of the greatest importance and undoubtedly will receive even more attention in the research laboratories of the industry in the future than it has in the past.

STUDIES IN NUTRITION

The great advances which have been made in our knowledge of the nutritional requirements of the human body in recent years interest no one more than the men of the packing industry, handling as they do one of the most important, perhaps the one most important, of all human foodstuffs.

Lean meat consists principally of what the chemist calls proteins, the chemical substances of which the active living cells of the body are composed—the “physical basis of life.” The proteins of meat are what are known as complete proteins; that is, they in themselves supply all that is required to build up the active living proteins of the body. This is in marked contrast to other proteins—for example those from many vegetable sources, such as the grains, which are incomplete. This incompleteness of vegetable proteins is one of the difficulties in the way of the so-called vegetarian diet. However, we have Bernard Shaw’s word for it that a vegetarian does not live on vegetables any more than a Catholic lives on cats. Not only do meats furnish complete proteins, but they furnish them in a very savory, easily digestible, and easily assimilable form. It

ESSENTIALS OF NUTRITION

FOODSTUFF	HEAT VALUE CALORIES PER GRAM	
1 - WATER	-	No life process can function without water.
2 - PROTEINS	4.1	Animal proteins from meat, eggs, or milk are complete. Most vegetable proteins are incomplete and must be supplemented by animal proteins.
3 - FATS	9.3	Fats have highest energy or fuel value.
4 - CARBOHYDRATES (Starch, Sugar,) etc.	4.1	Energy foods of lower fuel value than fats, which they can partly replace.
5 - MINERAL SALTS	-	Iron, Calcium (lime), Magnesium, Potassium, Sodium, Phosphates, Sulphates, Chlorides, etc.
6 - VITAMINES A-B-C	-	Vitamines differ fundamentally from all other foods. They have no energy or food value. Only very minute quantities required. Their chemical nature is unknown.
7 - ROUGHAGE OR BULK	-	The most concentrated foods are not necessarily the best for normal functioning of digestive tract.

has been shown that they have a higher biological value than any other form or source of protein. The savoriness of meat and meat products is so marked, and this appetizing quality is so rare among many foods, that it is a common practice to use meat not only for its own food value but for the purpose of conferring its flavor and savoriness upon other flavorless foods. Since these things are so, it is not strange that meat has been considered the central and most important part of the diet and has occupied the most prominent place on the table of mankind from immemorial times down to the present day. It has remained for certain misinformed persons and for others representing special interests, and for still others riding a hobby, to suggest and affirm that meat eating is harmful and that meat is capable of causing such diseases as cancer, hardening of the arteries, Bright's disease, and others. I hope it is not necessary to state here that there is no evidence whatsoever for these fallacious and malicious statements and that the proof lies both in scientific evidence and in the general experience of mankind.

THE VITAMINES

In addition to proteins, the older knowledge of nutrition stated that other necessities of diet were water, certain mineral salts, fats, and carbohydrates, such as sugar and starch. These ideas were based upon the composition of milk as determined by analy-

sis, milk being the natural food of the young of mammals and, supposedly, complete and perfect in itself. Since it contained proteins, fat, carbohydrates, mineral salts, and water, it was assumed that all of these things were essential, and that no others were necessary for a complete and perfect diet. The human body was a heat engine in which certain fuels called foods were transformed into heat and energy by combustion with oxygen under the influence of living processes. The energy output of the body was measured in a calorimeter in the same way that the energy of coal or oil is measured, and it was found that proteins had an energy value of 4.1 calories per gram, fats 9.3 calories per gram, and carbohydrates (starches and sugars) 4.1 calories per gram. These were named energy foods. The human body in a resting condition required a total of 2,000 calories per day. With active physical work, the energy requirement rose to 3,500 or even as high as 5,000 calories per day. However, it was found by various investigators that experimental animals were not completely nourished when fed purified foodstuffs of these classes, even though they were derived from milk itself, and evidence accumulated that other things were necessary. This evidence, together with clinical data concerning the deficiency diseases, beriberi and scurvy, led to the development of knowledge of the accessory factors of nutrition, commonly called *vitamines*. *Vitamines* are substances present in

very small quantity in a large number of foods necessary for growth and the maintenance of health (but only small quantities are required) and differ in nature from all other essentials of nutrition—proteins, energy foods, and salts. They are so widely distributed that it is difficult to find a food which does not contain at least traces of one or more of them. They are so difficult to separate and prepare in pure condition that their chemical nature has not been determined (nor is it likely that it will be determined for a long time to come), and so they are known only by their effects on bodily nourishment. Without them, growth and health cannot be maintained.

The vitamins are produced where all other foodstuffs are produced, in the green leaves of plants. In those marvelous cell laboratories, under the influence of the sun's rays, water, carbon dioxide, and the nitrogen of nitrates are combined and transformed into a great variety of complicated organic substances, among which are the well-known foodstuff groups.

At the present time, three vitamins are distinguished and are designated by the first three letters of the alphabet.

Vitamin A is sometimes called the growth vitamin. In its absence, growth cannot be maintained nor can the normal functions of the body be performed. In addition, a specific disease of the eye known as xerophthalmia, results. Vitamin A is present in quantity in the green leaves of plants, in

lettuce, cabbage, onion, and tomatoes, in milk and butter and oleo fats, and in many other foods. It reaches its highest concentration in codliver oil and is present in abundance in liver and kidney and other organs of meat animals.

Vitamine B is called the anti-neuritic vitamine. In its absence, the disease beri-beri results in human beings, and an analogous polyneuritis in experimental animals and fowls. These diseases can be relieved with remarkable promptness by the administration of a food containing the vitamine or a prepared extract of such a food. It is present in green leaves, leaf foods, in the germs of seeds, in liver, kidney, heart and other organs, to a moderate extent in lean meat, especially pork, and in other foodstuffs. It is perhaps the most widely distributed of all the vitamins. Vitamine B reaches its highest concentration in ordinary yeast.

Vitamine C is called the anti-scorbutic vitamine, because in its absence the disease known as scurvy, ensues, which has been the scourge of navies and of armies from the most ancient times. It is present in green leaves and characteristically in the citrous fruits, most prominently in the orange, the lemon, lime, and grape fruit, in descending order. It is also abundant in tomatoes and present in moderate quantity in most other fruits and green vegetables.

When the discovery of the vitamins was first announced, it was thought by the early investigators

that they were present in a few foods only, and some alarm was occasioned for fear that the average diet was deficient in these essentials of nutrition. A little reflection, however, showed that this could not be the case, since animals and man have been able to live in health and strength on the most varied diets, and this would indicate a wide distribution of vitamins, which was later found to be the case. The average diet contains enough and to spare of them, and it is only with restricted diets, such as may occur in the case of armies in the field, ships upon the sea, expeditions to distant parts of the earth, and so on, that a shortage of vitamins is at all likely to ensue. The point should be emphasized that the vitamins are of as much importance as any other constituent of the diet, as the proteins or mineral salts or water itself, but not more so. All are important and all are necessary for the maintenance of growth, health and strength.

THE DISTRIBUTION OF VITAMINES IN NATURE

The several tables, Nos. I, II, and III, show the general distribution of vitamins in natural foodstuffs. Table I is from the Lister Institute Report (*Report on the Present State of Knowledge concerning Accessory Food Factors* (Vitamins), compiled by a committee appointed by the Lister Institute and Medical Research Committee. London. His Majesty's Stationery Office, 1919). Table II was prepared by

TABLE I
THE DISTRIBUTION OF THE THREE ACCESSORY FACTORS IN THE COMMONER FOODSTUFFS.
LISTER INSTITUTE REPORT¹

Classes of Foodstuffs	A	B	C
Fats and oils:			
Butter..	++	0	.....
Cream.....	++	0	.....
Cod-liver oil.....	++	0	.....
Mutton fat.....	++		.....
Beef fat or suet.....	++		.....
Peanut or arachis oil.....	+		.....
Lard.....	0		.....
Olive oil.....	0		.....
Cottonseed oil.....	0		.....
Coconut oil.....	0		.....
Coco-butter.....	0		.....
Linseed oil.....	0		.....
Fish oil, whale oil, herring oil, etc.....	++		.....
Hardened fats, animal or vegetable origin.....	0		.....
Margarine prepared from animal fat.....	Value in proportion to amount contained		.....
Margarine from vegetable fats or lard.....	0		.....
Nut butters.....	+		.....

¹ Report on the *Present State of Knowledge concerning Accessory Food Factors (Vitamines)*. Compiled by a committee appointed jointly by the Lister Institute and Medical Research Committee. London. His Majesty's Stationery Office, 1919.

TABLE I—Continued

Classes of Foodstuffs		A	B	C
Meat, fish, etc.:				
Lean meat (beef, mutton, etc.)		+	+	++
Liver		++	++	
Kidneys		++	++	
Heart		++	++	
Brain		+	++	
Sweetbreads		+	++	
Fish, white		0	very slight if any	
Fish, fat (salmon, herring, etc.)		++	very slight if any	
Fish, roe		+	++	
Tinned meats		?	very slight	0
Milk, cheese, etc.:				
Milk, cow's whole, raw		++	+	+
Milk, skim, raw		0	++	+
Milk, dried whole		less than	++	less than
Milk, boiled whole		Undetermined	+	less than
Milk, condensed, sweetened		+	+	+
Cheese, whole milk		+		
Cheese, skim		0		
Eggs:				
Fresh		++	++	?
Dried		++	++	?

TABLE I—Continued

Classes of Foodstuffs	A	B	C
Cereals, pulses, etc.:			
Wheat, maize, rice, whole grain.....	++	+	0
Wheat, germ.....	++	++	0
Wheat, maize bran.....	0	++	0
White wheat flour, pure cornflour, polished rice, etc.	0	0	0
Custard powders, egg substitutes, prepared from cereal products.....	0	0	0
Linseed, millet.....	++	++	0
Dried peas, lentils, etc.....	.....	++	0
Pea flour (kilned).....	.....	++	0
Soy beans, haricot beans.....	+	++	0
Germinated pulses or cereals.....	+	++	++
Vegetables and fruits:			
Cabbage, fresh.....	++	+	++
Cabbage, fresh, cooked.....	.....	+	+
Cabbage, dried.....	+	+	very slight
Cabbage, canned.....	.....	.....	very slight
Swede, raw expressed juice.....	.....	.....	++
Lettuce.....	++	+	.....
Spinach (dried).....	++	++	.....
Carrots, fresh raw.....	+	+	.....
Carrots, dried.....	very slight	.....	+
Beetroot, raw expressed juice.....	.....	.....	less than +

TABLE I—Continued

Classes of Foodstuffs	A	B	C
Vegetables and fruits— <i>Cont'd.</i>			
Potatoes, raw.....	+		+
Potatoes, cooked.....		+	+
Beans, fresh, scarlet runners, raw.....			+
Onions, cooked.....			+
Lemon juice, fresh.....			+
Lemon juice, preserved.....			+
Lime juice, fresh.....			+
Lime juice, preserved.....			+
Orange juice, fresh.....			very slight
Raspberries.....			+
Apples.....			+
Baranas.....	+	+	+
Tomatoes (canned).....			+
Nuts.....	+	+	+
Miscellaneous:			
Yeast, dried.....		+	
Yeast, extract and autolysed.....	?	+	0

TABLE II

DISTRIBUTION OF THE THREE ACCESSORY FACTORS IN FOODSTUFFS

The references given are the latest obtainable. Data without references obtained from Lister Institute Report and correlated with the notation adopted in these tables.

+ indicates presence. ++ 50 per cent or more required in diet. +++ 20 per cent gives ample supply. ++++ 5 per cent or less sufficient. ++++ highest activity.

Class and Description	A	B	C	Reference
<i>Oils and Fats</i>				
Cod-liver oil (cold pressed oil).....	++++	Drummond <i>et al</i> , <i>Biochem. J.</i> , XIV, 665 Steenbock <i>et al</i> , <i>J.B.C.</i> , XLVII (1920), 89
Butter (June butter from Jersey cows).....	++++	<i>Ibid.</i> Mendel, <i>N.Y. State Med. J.</i> , XX (1920), 212, 0.1 g. nearly sufficient, 0.1 g. dry tomato does suffice.
Liver oil (shark, tunny fish).....	++++	Sekine, <i>J., Tokyo C. Soc.</i> , XLI (1920), 426
Whale oil (partly refined).....	++++	Drummond, <i>J., Phys.</i> , LII (1919), 344
Fish oil.....	++	
Cream (from pasture fed cows)....	+++	+	+	

TABLE II—Continued

Class and Description	A	B	C	Reference
<i>Oils and Fats—Continued</i>				
Beef fat.....	++			Drummond <i>et al</i> , <i>Biochem. J.</i> , XIV (1920), 665
Dog fat.....	++			<i>Ibid.</i>
Horse fat.....	++			<i>Ibid.</i>
Palm oil (cold pressed).....	++			<i>Ibid.</i>
Maize oil (cold pressed).....	++			<i>Ibid.</i>
Pig fat.....	++			
Oleo oil.....	++			Drummond <i>et al</i> , <i>Biochem. J.</i> , XIV (1920), 742
Mutton fat.....	++			Drummond <i>et al</i> , <i>Biochem. J.</i> , XIV (1920), 665
Soy bean oil.....	++			
Linseed oil.....	++			
Cottonseed oil.....	+			
Olive oil.....	+			B.C.P., <i>Jansen Chem. Weekblad</i> , XV (1974)
Coconut oil.....	+			
Cocoa butter.....	0			
Hydrogenated oils.....	0			
Peanut oil.....	++			
Lard (rendered at low temp.).....	+			
Lard (refined).....	0			Daniels and Loughlin, <i>J.B.C.</i> , XLII, 359

TABLE II—Continued

Class and Description	A	B	C	Reference
<i>Oils and Fats—Continued</i>				
Rape oil.....	+			<i>Abderhalden Arch. gesam. Physiol.</i> (1919), 175, 187
Oleomargarine (made with oleo oil).	++			
Oleomargarine (made with vegetable oil).....	0			
Butter (from cows on winter ration)	+			
<i>Meat, Fish</i>				
Kidney.....	++++	+++	+	McCollum <i>et al</i> , <i>J.B.C.</i> , XLVII (1921), 111 <i>Ibid.</i> <i>Ibid.</i>
Liver.....	+++	+++	++	
Heart.....	++	++	++	
Lean meat (muscle).....		+	++	<i>Ibid.</i>
Brain.....	++	+		Swoboda, <i>J.B.C.</i> , XLIV, 531, 1921 <i>Ibid.</i> <i>Ibid.</i> <i>Ibid.</i> <i>Ibid.</i> <i>Ibid.</i> <i>Ibid.</i> <i>Ibid.</i>
Spleen.....	++	++		
Testis.....		++		
Ovary.....	+	++		
Pituitary.....		++		
Nervous tissue.....		++		
Thyroid.....		++		
Pancreas.....		++		
Pineal gland.....		++		
Thymus.....	++	++		

TABLE II—Continued

Class and Description	A	B	C	Reference
<i>Meat, Fish—Continued</i>				
Canned meat.....	+	+	0	Cole, <i>Royal Food Comm. Royal Soc.</i> , 1017-8
Lean fish.....	+	+	0	
Fat fish.....	++	+	0	
Fish roe.....	++	++	
Blood.....	Koga, <i>Bull. Naval Med. Assoc. Tokyo</i> , Nov. 1920
Dried meat.....	0	
Salt pork.....	0	<i>Ibid.</i>
Salt fish.....	Swoboda, <i>J.B.C.</i> , XLIV, 531, 1921
Suprarenals.....	+	
Lung.....	+	Dutcher, <i>J.B.C.</i> , XXXVI (1918), 63
<i>Eggs, Milk, and Dairy Products</i>				
Egg, fresh.....	++	++	+	Jephcott and Bacharach, <i>Biochem. J.</i> , XV (1921), 138
Egg, dried.....	++	+	
Egg, yolk.....	++	++	
Cheese, whole milk.....	++	+	
Milk, June fed.....	++	++	++	
Milk, winter fed.....	+	++	++	
Milk, condensed in vacuum.....	++	++	++	

TABLE II—Continued

Class and Description	A	B	C	Reference
<i>Eggs, Milk, and Dairy Products—Continued</i>				
Milk, dried (vacuum pan).....	++	+	+	<i>Conrie Edin. Med. J.</i> , XXIV (1920), 207
Milk, lactic acid culture.....	+	+	+	
<i>Miscellaneous</i>				
Yeast.....	0	++++	0	<i>Curatolo Polyclinico</i> , XXVII, Med. Sec. (1920), 439 <i>Harden & Robison, J. Army Med. Corps</i> , XXXII (1919), 48 <i>Faber, J.B.C., XLIII</i> (1920), 113 <i>Dutcher et al, J.B.C.</i> , XXXVI (1918), 551
Meat extract.....	0	0	0	
Beer.....	0	0	0	
Rabbit urine.....	0	+	.....
Apple jelly.....	.....	.....	++	<i>Willaman, J.A.C.S.</i> , XLII (1920), 549
Honey.....	.....	++	0	
Corn pollen.....	.....	++	.....
Mold, <i>Aspergillus niger</i>.....	.....	+	.....	<i>Pacini & Russell, J.B.C.</i> , XXXIV (1918), 43
" <i>Sclerotinia anerca</i>.....	.....	+	.....
Typhoid culture. Alcohol extract of bacterial cells.....	+	+	.....	<i>Willaman, J.A.C.S.</i> , XLII (1920), 568
Fungus. Sporangium of scleroderma Sp. and <i>Collybia</i> sp.....	.....	+	.....

TABLE II—Continued

Class and Description	A	B	C	Reference
<i>Seeds</i>				
Hemp.....	++	—	—	McCollum, Simmonds & Pitz, <i>J.B.C.</i> , XXX (1917), 13
Flax.....	++	++	—	<i>Ibid.</i>
Maize (yellow endosperm).....	+++	+	—	Steenbock & Boutwell, <i>J.B.C.</i> , XLI (1920), 81
Sunflower.....	++	+	—	
Soy bean.....	++	++	—	
Navy bean.....	++	++	—	
Pea.....	++	++		
Cottonseed (press cake).....	++	+		Richardson & Green, <i>J.B.C.</i> , XXV (1916), 307
Peanut (press cake).....	++	+	.....
Flaxseed (press cake).....	++	+	.....
Soy bean (meal).....	++	+	.....
Maize (white endosperm).....	+	+	.....
Wheat.....	+	++	.....
Rye.....	+	++	.....
Barley.....	+	++	.....
Oats.....	+	++	.....
Rice (whole).....	+	++	.....
Rice (polished).....	0	0	.....
Millet.....	+	+	.....
Wheat (bran).....	++	++	.....

TABLE II—Continued

Class and Description	A	B	C	Reference
<i>Seeds—Continued</i>				
Wheat (embryo).....	++	+++++	Chick & Delf, <i>B.J.</i> , XIII (1919), 199; McClendon, <i>J.B.C.</i> , XLVII (1921), 411
Maize (embryo).....	++	+++++	
Rice (embryo).....	+	+++++	
Germinated seeds.....	+	++	+++	
<i>Vegetables and Grasses</i>				
Tomato, fresh.....	+++++	++++	+++++	Osborne <i>et al.</i> , <i>J.B.C.</i> , XLI (1920), 451
Tomato, canned.....	++++	++++	++++	
Alfalfa, cut before ripening.....	+++++	+++++	++++	
Spinach, cut before ripening.....	+++++	++++	++	Osborne <i>et al.</i> , <i>J.B.C.</i> , XXXIX (1919), 29
Clover, cut before ripening.....	+++++	+++++	++++	
Timothy, cut before ripening.....	+++++	++	+	Eddy & Stevenson, <i>J.B.C.</i> , XLIII (1920), 295
Radish.....	++	
Sweet potatoes.....	++	+	+	Steenbock <i>et al.</i> , <i>J.B.C.</i> , XLI (1920), 149
Carrot, fresh.....	++++	++++	++++	Steenbock <i>et al.</i> , <i>J.B.C.</i> , XL (1919), 501
Chard.....	++++	++	++++	<i>Ibid.</i>
Lettuce.....	++++	+	++	<i>Ibid.</i>

TABLE II—Continued

Class and Description	A	B	C	Reference
<i>Vegetables and Grasses—Continued</i>				
Squash.....	++	+	++	<i>Ibid.</i>
Cabbage.....	++	++	++	<i>Ibid.</i> , also Zilva, <i>Biochem. J.</i> , XIV (1920), 494
Onion.....	++	++	++	<i>Ibid.</i>
Beet root.....	+	+	+	
Beet tops.....	+	+	+	
Parsnips.....	+	+	+	
Potatoes.....	+	+	+	
Mangels.....	+	+	+	
Turnip.....	+	++	++	
Cucumber.....	+	+	+	
Swedes.....	+	++	++	Delf, <i>B.J.</i> , XIV (1920), 211
Dasheen.....	+	++	++	See Steenbock above
Brinjal, sun dried.....	0	+	0	Shorten & Ray, <i>Biochem. J.</i> , XV, ii (1921), 284
Celery.....	+	+	++	Eddy & Stevenson, <i>J.B.C.</i> , XLIII, 295
Dehydrated vegetables.....	.....	.....	0	Hess & Unger, <i>Am. J. Dis. Ch.</i> , XVII (1919), 236
<i>Fruits and Nuts</i>				
Orange.....	++	++	++	Davey, <i>Biochem. J.</i> , XV (1921), 83
Lemon.....	++	+	++	
Lime.....	+	+	++	

TABLE II—Continued

Class and Description	A	B	C	Reference
<i>Fruits and Nuts—Continued</i>				
Banana.....	+	+	+	Lewis, <i>J.B.C.</i> , XL (1919), 91 Sugiura & Benedict, <i>J.B.C.</i> , XL (1919), 449
Apple.....	+	+	+	Hess & Unger, <i>Am. J. Dis. Ch.</i> , XVII (1919), 234
Grapefruit.....	+	+	+	
Prune, dried.....	+	+	+	
Grapes.....	+	+	+	
Pears.....	+	+	+	
Rhubarb, either solid or raw and boiled juice.....	+	+	+	Pierson & Dutcher, <i>Science</i> , LI (1920), 70
Peanut.....	++	+	Drummond <i>et al</i> , <i>Biochem. J.</i> , XIV, 665
Brazil.....	+	+	Cajori, <i>J.B.C.</i> , XLIII (1920)
Barcelona.....	+	+	
Walnut.....	+	+	
Almond.....	+	+	
Chestnut.....	++	
Pecan.....	+	
Filbert.....	+	
Hickory.....	+	
Pine nut.....	+	

TABLE III*

VEGETABLE FOODS

	A	B	C
1. Green parts, Av. of 5.....	++++	+++	++
2. Secondary green parts, storage leaves, Av. of 3 (lettuce, cabbage, onion).....	++	++	++
3. Roots, Av. of 7.....	+	++	++
4. Legume seeds, Av. of 3.....	++	++
5. Cereal grains, Av. of 7.....	+	++
6. Oil seeds, Av. of 4.....	+++	+
6a. Germinated seeds.....	+	++	+++
7. Nuts, Av. of 10.....	+	+
8. Citrous fruits, Av. of 4.....	+	+	+++
9. Other fruits, Av. of 5.....	+	+	+
10. Flowers. Not investigated			
11. Vegetable oils, Av. of 8.....	++

* This table is a compilation from Table II and is made up of averages of the different classes of natural foods arranged in 21 groups. While this method of procedure may be questioned, it has a tendency to eliminate inaccuracies of individual determinations which are a necessary concomitant of the present stage of vitamin investigation.

ANIMAL FOODS

	A	B	C
12. Glandular organs, liver and kidney.	++++	+++	+
Others, Av. of 6.....	++	+++
13. Fats, Av. of 4.....	+++
14. Lean meat.....	+	+
15. Fish, lean.....	+	+	0
Fish, fat.....	+++	+	0
16. Milk (June).....	++	++	++
Milk (winter).....	+	+	+
17. Eggs.....	+++	+++	+
18. Insects, not investigated			
19. Shellfish, not investigated			
20. Crustaceans, not investigated			

Mr. Kenneth K. Jones, biological chemist attached to the Research Laboratory of Swift & Company. Table III is a compilation from Table II.

RESEARCH IN THE CANNING INDUSTRY

While the canning industry is now divorced from the packing industry proper by the terms of the so-called "Consent Decree," it may be of interest to say a few words in regard to research in this branch.

Preservation by means of heat sterilization was thought to have reached its full development some years ago, and no essential changes have been introduced in the processes used recently. To be sure, the machinery and the details of handling have undergone continuous evolution. The lining of tinned cans and the tin coating itself has received much attention, and a greater variety of products is placed on the market each succeeding year; but the principle developed by Francois Appert in 1804 is still applied. For many years it was thought that canned goods were universally sterile, provided they did not swell. Scientific investigation has indicated that this is not the fact. Numberless details connected with the canning of all sorts of product have been investigated by the National Cannery Laboratory, established by the canning industry as a central bureau of investigation, all with the view of placing on the market the greatest possible variety of canned goods in the soundest and most wholesome condition.

OTHER RESEARCH PROBLEMS

It would require too much time and space at this point to place in detailed review the long list of questions arising for solution in all the various main and by-product departments of the packing industry. In the cold storage of product, in the curing of meats, in the oils and fats branches, including lard, vegetable oils and margarine, in the glue, gelatin, soap, fertilizer, and animal feed departments, in connection with water supply and the disposal of wastes, there are numerous fields of investigation for the research establishment. The Institute of American Meat Packers is about to appoint a Director of Scientific Research, whose office it will be to direct investigation of selected problems from these various departments for the benefit of the entire industry.

THE SELECTION OF PROBLEMS FOR RESEARCH

The best and most successful research chemist is the one who is able to select problems which are most in need of solution and most likely to be solved within a reasonable time. At first glance, it might seem impossible that this could be done. How is a man to know which problems are solvable, or readily solvable, and which ones are not, until he makes the attempt? How is he to know the fruitful from the unfruitful problem. the profitable from the unprofitable? All that can be said on these points is that there are men who can do it and there are men who

do not do it. Of two men of equal training and, generally speaking, of equal ability, the one will devote his days assiduously to getting nowhere, while the other, at a minimum expenditure of energy, will attack a problem which to him promises success and bring it to a successful termination with a minimum expenditure of energy. Whether he be guided by instinct, by special knowledge, by intuition or by all three, it is hard to say, but to be successful in research it is necessary to have this peculiar insight leading to a selection of problems which in themselves and in the present stage of knowledge are not likely to be found impossible or even excessively difficult of solution. The successful research man in this industry, as in all industries, is he who knows how to eliminate the unprofitable problems and concentrate on the important ones remaining.

THE CHEMIST AS CONSULTANT

Our discussion of the chemist would not be complete without referring to his work in the capacity of consultant with the engineers, heads of departments, and foremen in regard to various chemical matters or practical and manufacturing problems which involve applications of chemistry. Consultations of this sort take up no small part of the chief chemist's time. Connected therewith are also numerous conferences relating to new developments, increased manufacturing facilities, modifications of

existing processes, quality of products, matters of health and sanitation, rulings of the Bureau of Animal Industry, and many others. The general subject-matter of consultations varies from the most trivial to the most important.

LABORATORY COSTS

It may be of interest to know something about the costs of laboratory analytical work and research as compared to the raw material purchased and the products sold.

The large packing-houses spend annually for scientific work of this sort from \$100,000 to \$400,000. Although these sums are large, when calculated to the basis of live stock, meat, and by-products, the costs are not excessive. Typical costs are 1.4 cents per head of animals slaughtered or 1/200 of a cent per pound of weight of live stock. Calculating another way, we find that the costs amount to 3/100 of 1 per cent of sales. The following distribution of the annual laboratory expense is also of interest:

ANNUAL EXPENSE	
	Per Cent
On Edible Product.....	13
On Inedible Product.....	16
On Soap.....	16
On Research.....	55
	<hr/>
	100

CO-OPERATION BETWEEN SCIENTIFIC AND
PRACTICAL MEN

I have tried to indicate in this paper that the conversion of an empirical and rule of thumb plant and management to a scientific basis cannot be accomplished alone by the introduction of scientific men into the organization. There must be, in addition, a cordial spirit of receptivity on the part of the management and the operating men, and a genuine desire to improve and progress along scientific lines. The balance between a wise conservatism and rational progress must be maintained. No process or new line of manufacture should be entered into rashly or without due consideration; but on the other hand, the managers of the business should never permit a reactionary superintendent, department manager or operating foreman to stand in the way of developments and inventions which careful experiments have proven to be of benefit to the business. One often hears it said that the practical man fails to understand the scientist because the scientist does not speak the practical man's language, but it would be just as reasonable to say that the practical man fails to understand the scientist because he makes no effort to learn the language of science. One cannot hope to understand science or scientific men in any degree unless one is prepared to learn a part, at any rate, of the language of science, any more than one who knows no French words can hope to understand a

Frenchman. There should be a convergence of both ideas and men, scientific and practical. It is highly desirable that the scientific man should become more practical and that the practical man should become more scientific. This will result in a better understanding of each other's aims and is the first step toward that co-operation which is essential if the business is to progress and compete under modern industrial conditions.

SCIENCE CHARACTERISTIC OF THE AGE

The present age is characterized by the development of the sciences and by the application of science to industry and to everyday life. The scientist has made the present age what it is. The development of any age is dependent primarily on three classes of men: the scientists, the engineers, and the artists; but artists and engineers have performed their marvelous works in all ages. In this age alone, the scientist has been permitted to transform the physical aspects of civilization.

The present age also has been called the money-making age, the age of industry, the iron age, the age of organization; but money-making has been characteristic of all ages, industries and organizations have existed in most ancient times, and iron has been smelted and worked for 5,000 years or more. When one thinks of the organization required to construct the great pyramid of Chefu at Ghizeh, on which we

are told by Herodotus one hundred thousand men were employed for twenty years, and when we consider the remarkable orientation of that structure and the excellent engineering required, we must conclude that the ability to organize and to maintain organizations was quite as well developed twenty-six hundred years before Christ as in the present day. Artisans and craftsmen of ancient times were quite the equal of those of the present; in fact, on the average, they were vastly superior, because handicraft, since machines entered the industries, has not been cultivated to the same extent as before. The ancient engineers were capable builders, working with what tools and materials of construction they possessed. Only the modern scientist outranks all of his class who have gone before—largely because of accumulated knowledge, but more because he has found and makes use of a method of work, the scientific method. The one outstanding characteristic of our times is the great expansion of the scientific method and the application of scientific results.

MODERN SCIENCE

If our lives are comfortable, if we are safe, if we are more or less independent of the antagonistic enemy forces of nature, if we are free of famine and pestilence and can control disease, if large populations can subsist in comfort in small areas; in short, if the hardships of life are reduced and the enjoyment of

life increased, the result is due to scientific thought and scientific practice. Only in-so-far as scientific methods are applied to the production of wealth, in the best sense of the expression, and to the needs of everyday life, are these things possible. Those nations which cultivate science will be the great nations of the future. Of all the sciences, chemistry has the greatest possibilities of application, the greatest potential transforming power, because of its universality, because of the fact that there is no process or product, no phenomenon or event, no condition of industry or of everyday life for which it does not have an interpretation or a suggestion for improvement. For the arts of peace or the malign purposes of war, chemistry is the most powerful agency which we possess. As an agency in the arts of peace it has the power of transforming our industries, the physical aspects of our civilization, and of our conditions of life, while as a destructive force in war it may well cause the enemy to fear or to yield. Those nations and those industries alone which cultivate chemistry in the future can hope to be successful in the international and economic struggle for existence.



F. EDSON WHITE

Lecture VIII

DISTRIBUTION OF MEAT PRODUCTS

BY

F. EDSON WHITE



DISTRIBUTION OF MEAT PRODUCTS

Distribution, in the sense that we are considering it in this lecture, contemplates moving the surplus products from the lands of plenty to the places where they are needed in greater abundance than they can be grown. It also involves marketing each grade or class of product in such manner as to assure the best possible monetary returns. Thus, it appears that distribution comprises, first, physical transportation and, second, salesmanship.

Evils of inefficient distribution.—Inadequate distribution has been the curse of many of the most productive areas in the world. Russia, for example, is a wonderfully fertile land with tremendous natural resources such as few other countries enjoy, and yet time after time the world has seen the people of some part of Russia hungering, with surplus foods or the possibility of producing surpluses only a few hundred miles away.

That North America today is not in the same condition as South America is because of efficient distribution. North America has railroads, water transportation, motor trucks, and an ever increasing mileage of permanent roads; it has industries organized on a coast-to-coast basis, which enables the placing of every surplus at the point where it is needed. North

America is the greatest, richest, most powerful empire in the world, but without adequate distribution, encompassing transportation and salesmanship it is probable that North America would be a comparatively barren land, harboring only a fringe of fishermen along the coasts and a few hardy adventurers in the interior. South America, like Russia, has tremendous productive potentialities, but development awaits improvement in distributive facilities.

Personal benefits from efficient distribution.—There is no danger that one section of our country will starve while other sections have plenty. Distribution here is in good hands. With my breakfast I had grapefruit from Florida. I could have had oranges from California or figs from Egypt. Every day we Chicagoans have on our tables products that do not grow within a thousand miles from here. The same thing is true in every city, town, and hamlet in the country.

Distribution enables specialized local production.—Satisfactory distribution enables every section to produce to its capacity the product or products which it is best suited by nature to produce, and to exchange its surplus for the products which other sections can produce better or more economically. Free and untrammelled exchange of products enables producers everywhere to secure the best possible returns for their product. Thus, it is possible for Florida and California to devote far more time and area to pro-

ducing oranges than would be justified by the demand for oranges in those states. So it is also with apples in Washington and Oregon. Michigan devotes much of its land to the production of luscious peaches and pears. The bulk of our rice comes from Louisiana, Arkansas, and Texas. The Ohio River Valley, western Kansas, and the bread-basket states—Minnesota, the Dakotas, and Montana—produce the bulk of our small grain.

Getting down to meats, we find that the Rocky Mountain region produces the biggest surplus of lambs; that the broad plains sloping eastward from the Rockies produce the surplus cattle, and that the northern half of the Mississippi Valley states accounts for the bulk of the hog production.

Centers of consumption.—A thousand to fifteen hundred miles east of these sections of surplus production are great centers of population, nearly all located in states that are far understocked with meat-animals in proportion to the productiveness of their soils. These centers are located along the Atlantic seaboard and inland for a space of about 300 miles. North of the Carolinas and east of Ohio is a section containing about 32 per cent of the nation's population. This densely inhabited territory is largely given over to industrial purposes, and hence the people living there consume far more food than they produce. Getting meat from the surplus-producing sections of the West to these heavy-consumption centers in the

East is a distribution problem which has been solved by the nation's meat-packing industry.

LOCAL AND NATIONAL PACKERS

I do not wish to leave the impression that the entire meat-packing industry is engaged in moving meat from the West to the East.

The local packer.—A large number of meat packers are engaged primarily in local distribution. The average small packer sells his product in the territory immediately surrounding his plant, and, in so far as is possible, he draws his raw material supply from the same territory.

The local packer in national distribution.—It is only when his territory fails to supply his needs that he is compelled to go to distant markets to purchase raw materials. Thus, it happens that when the small packer functions as a national distributor—that is, one who helps to move the surplus of one section to another section which is deficient—he more commonly moves live animals. This is less economical than moving the finished product, but as long as the small packer buys only for his immediate territory, he is able to overcome the lack of economy in moving live animals by the lower costs incident to local distribution.

The national packer.—Primarily the small packer is not engaged in moving the surplus of one section to meet the deficiencies in a distant section. On the

other hand, the large packers who do business on a national scale have this section-to-section distribution as their chief function. This requires the big packers to have extensive equipment in the way of large-capacity coolers, refrigerator cars, extensive selling organizations, etc. The result is a heavier overhead expense proportionately than is born by the smaller packers. To offset this difference in overhead and to compete successfully in the territories served by the local packers, the national packers must develop great volumes of business.

Balance between distribution of animals and meats.—While not exactly pertinent to my subject, it is perhaps of importance at this time to point out the factors that maintain the balance between the packers who largely ship dressed meats and those who largely ship live animals. There is no question but that the meats of the packers who ship carcasses cost more, delivered with the freight charges on top, especially when the steady overhead of branch houses and selling forces is added, but there are two advantages that accrue to this class of packer which in times past have tended to offset the handicap of freight and selling costs. The first of these came from the credits on by-products, which could not only be saved in large quantities, owing to the volume of business the packer shipping meats all over the country was able to develop, but could be utilized more completely. The second advantage came in the choice of place

of sale, since once the meat was ready for shipment at a central point it could be billed to the particular market where the highest prices for that type of meat were prevailing, whereas the packer slaughtering at a consuming center was forced to sell his meat at the point of slaughter or else place a double transportation charge for live-animal shipment and for meat shipment on his finished product.

Volume in relation to production and varied distribution.—The service of the two classes of packers from the consumer's standpoint perhaps differs only slightly in its fundamental aspects, but, from the standpoint of the producer, the national packer is of prime importance, since he alone can provide at one point the varied outlet for all the kinds, grades, and classes of live stock that are the natural product of varied-breeding herds. No local packer could get the necessary assortment of meat at the time the northwest-range cattle run in the fall or the heavy-hogs run in the spring without excessive costs on mixed or less-than-carload shipments. The national packer, on the other hand, because of his volume, can buy in large quantities and make up his assortments for the trade at any point.

The story of the introduction of western meat to eastern markets is most interesting, and seems entitled to mention in a paper dealing with the distribution of meat. As was reasonable to expect, eastern slaughterers did not look kindly upon the efforts of western

meat-packers to invade their market, and out of this situation grew a definite campaign against western meat. Human and sectional prejudices were played upon, and at the beginning of the business the Westerners had practically to give away their meat in order to introduce it into the eastern retail stores. Some of the pioneers in the business of distributing meat shipped carload after carload of western-killed beef into eastern markets, and instructed their agents to get it into the retail stores without regard to the price secured for it. Extensive advertising had to be done to convince eastern consumers that they could eat western-killed beef without fear as to its wholesomeness.

In time, of course, the eastern consumers learned that there is no better beef than that which comes from the West, and eastern slaughterers learned that their business could compete profitably with that of the western killers. In fact, it was unjust to eastern consumers to expect them to pay the price levels for meat necessitated by the cost of meat production on the restricted acres of the East, and meat distribution on a national scale was therefore effected.

THE FACILITIES FOR DISTRIBUTION

The mechanics of distribution.—The reader probably already is sufficiently acquainted with the physical means of distribution, and it seems hardly more than necessary to mention that these physical means con-

sist, first of all, of live-stock markets where producers can instantly turn their meat-animals into cash; packing plants adjacent to the markets; coolers and freezers of sufficient capacity to care for day-to-day receipts; refrigerator cars for moving products from the coolers toward the consuming centers; refrigerated branch houses in the actual consuming centers; fleets of motor trucks for local delivery; and, finally, the retail stores where the housewives make their purchases of meat. These, in effect, are the means of transportation of the product from its source of production to the point where it is to be consumed. Distribution entails using this means of transportation to best advantage.

SOME CHARACTERISTICS OF LIVE-STOCK SUPPLY

Not all packing plants are equally well situated with respect to delivering their products to any particular market. This is due in part to transportation facilities or lack of them, and in part to differences in quality of meat animals and differences in demand for meat. The live stock of the Southwest differs materially from the live stock of the corn belt, and consequently the meat from the two sections is different. On the other hand, the consumers of the Northeast demand a different sort of meat from that which is demanded by the consumers of the southeastern states. These differences in quality and differences in demand affect distribution.

Relation of specialized live-stock supply to adjacent packing houses.—Fort Worth and Oklahoma City, for example, supply very little meat for the densely populated section of the country directly east of the Ohio border. This section draws upon the Missouri River markets—Kansas City, St. Joseph, Omaha, and Sioux City—and upon St. Louis and Chicago. On the other hand, Fort Worth and Oklahoma City can market a product in the southeastern states to much better advantage than the river markets, because they have a product best suited to this demand. One of the largest plants in Chicago sends from 95 to 98 per cent of its pork and pork products into the Middle Atlantic states. A large Sioux City plant sends 70 per cent of its pork and pork products to this same section, while a St. Paul plant, owned by the same firm, distributes only 20 per cent of its pork and pork products in this area. Throughout the Northwest, pork products are supplied from the St. Paul, Denver, Spokane, Portland, and Seattle points of slaughter, while in the Southwest, Fort Worth, Oklahoma City, Wichita, Pueblo, Denver, El Paso, and Los Angeles perform the same function. An interesting fact in this connection is that it is almost as easy to take meats east as it is to distribute to these more sparsely settled areas, largely because of the arrangement of railroad trunk lines and the lack of branch lines. Hence it frequently happens that the cost of distribution many miles eastward is

much less than it is in the mountain states, the range country, or over parts of the Pacific Coast. I point out these facts mainly to show that transportation is an important factor in distribution, for it is the existing transportation facilities which account to a large extent for the direction and distribution of shipments.

GEOGRAPHICAL DISTRIBUTION

Consumptive demand varies greatly among the populations of different sections of the country. The kind of beef or pork most desirable for the New England markets does not find a ready sale in the southern states, for example. The beef slaughtered along the Pacific Coast could be marketed only with difficulty along the North Atlantic. Adequate distribution demands that provision be made to supply the actual wants of a section, and it many times happens that these wants can be supplied only by going beyond the packing center most conveniently situated to supply them.

Variations in beef demand.—Perhaps a detailed discussion of some of these fluctuations in demand will present the idea more concretely. For example, the beef trade is largely based upon New York and New England. New York, Jersey City, and the adjacent regions take all grades and classes of beef. The down-town houses in New York City handle a varied assortment, mostly weighty, for the large shops and the hotel- and restaurant-supply trade. These

houses handle almost everything except yearling beef. On the other hand, the Hudson River territory, to the north of New York, demands a greater proportion of medium to choice carcasses with lighter weights, while the Long Island and the Harlem sections of the city constantly demand the best light carcasses, predominantly yearlings, available. Philadelphia takes a general assortment like New York, demanding all grades from plain to choice, but their price levels are likely to run lower except on the good to choice carcasses.

Kosher beef.—In New York we come in contact with another factor affecting distribution. There are more orthodox Jews in New York City than in any other great consuming center in the country, and the orthodox Jews require kosher beef. Kosher beef, under ordinary conditions, must be in the hands of the consumer within seventy-two hours after slaughter. Consequently, western-killed beef will not serve to satisfy the needs of New York's Jewish population, because it ordinarily takes a beef train four days to move from Chicago to New York. This fact accounts for numerous slaughtering establishments adjacent to New York which would otherwise not be there. Many of the corn-fed steers from the West are shipped alive to New York to be koshered—and it is noteworthy that the Jews require a very high-grade meat-animal. For obvious reasons kosher beef is ordinarily somewhat higher in price than regular beef.

New England beef trade.—Boston is the market of heavy beef. The carcasses must be strong and well finished, steer beef running from 800 pounds up and cow beef from 600 pounds up. Boston is really the hub of the entire New England beef trade, although southern sections of New England usually vary from the northern and western ones by demanding lighter sides. The farther south one goes along the seaboard the lighter carcasses are in demand. Not only lightness but leanness in beef best suits the consumers of Old Dixie.

Mid-West beef trade.—The Mid-West, composed of the east and west North Central states, consumes the fair to medium grades, with more fed cattle than are included in the South or West. The most desirable carcasses for this section weigh from 400 to 600 pounds, but should not be overly fat. The principal cities of this section—Chicago, Milwaukee, St. Louis, Kansas City, and Omaha—with their adjacent selling territories, are relatively uniform in their demand. All classes of beef may be sold, but principally light-butcher cattle are desired. The shop trade in particular demands yearling heifers and steers which are medium to choice in quality.

An interesting vagary of demand is illustrated in the Twin Cities, Minneapolis and St. Paul. Minneapolis seeks more fed cattle than St. Paul and maintains a more active market, but Minneapolis cattle preferably weigh from 300 to 600 pounds in the carcass,

while St. Paul cattle weigh from 500 to 700 pounds. Further examples might be drawn from other sections, but the foregoing illustrates the general problem to be considered in beef distribution.

Variations in pork demand.—These questions are not confined to beef, however, but apply to the lamb and mutton trade and to the pork trade as well. Before the war the Southeast was the best outlet for the large, dry-salt bellies to be sold in the negro trade, while the white trade demanded light bacon, with four- to six-pound bellies in greatest demand. New England, on the other hand, asked for the same mild-cured bacon, but was willing to use ten- to twelve- and twelve- to fourteen-pound bellies, providing they were solidly-meated and of good quality. Hotel and restaurant trade desires pork loins and hams weighing about ten pounds, while shop and family trade insists that the same cuts of meat must weigh less.

Marketing the biggest problem of packing.—This survey of sectional demands for meat products makes it apparent to the careful observer that the slaughtering of live animals and the dressing and shipping of carcasses is the easiest part of the business. The big job is to find markets. We must have facilities for doing business in a sufficient number of consuming centers to assure an outlet for our product and to permit the closest possible contact so that each grade of meat may go to the market demanding it the strongest and willing to pay the most for it.

SEASONAL DISTRIBUTION

Thus far, distribution has been considered only in relation to moving the product from one place to another and to securing the highest price for the product. A second factor of distribution is that of time or season. In other words, there must be distribution over the different times of year as well as over the country. If consumption had to be coincident with production, there would be seasons when meat would be exceedingly scarce and beyond the reach of the ordinary pocketbook, while at other seasons there would be so much meat available that the price would drop far below the cost of production, thus failing to warrant the production. In other words, production would not continue at its present level, but would drop far below it.

The boiled ham that features the Fourth of July picnic, as likely as not, came to market in the live hog some time during the preceding winter. By far the heaviest marketing of live stock comes in the colder months of the year, due largely to the fact that the animals cannot be marketed until they have consumed the grain, hay, and roughage crops of the growing season. On the other hand, the heaviest consumption of meat products is likely to come in the hot months when labor is most fully employed and energy-demands in the diet are the greatest.

The table which is printed below shows the general nature of the problem of fitting consumption and

production, as expressed by the rate at which live stock has been marketed in bi-monthly periods for the three years 1919, 1920, and 1921, and the rate at which its product has been marketed, as represented by the sales of one of the national packing companies during the same period. This company's sales probably do not represent exactly the rate of consumption throughout the country, but I feel that they come near enough to being exact to make clear the nature of the problem.

AVERAGE PERCENTAGE RELATIONSHIPS OF
PRODUCTION TO CONSUMPTION

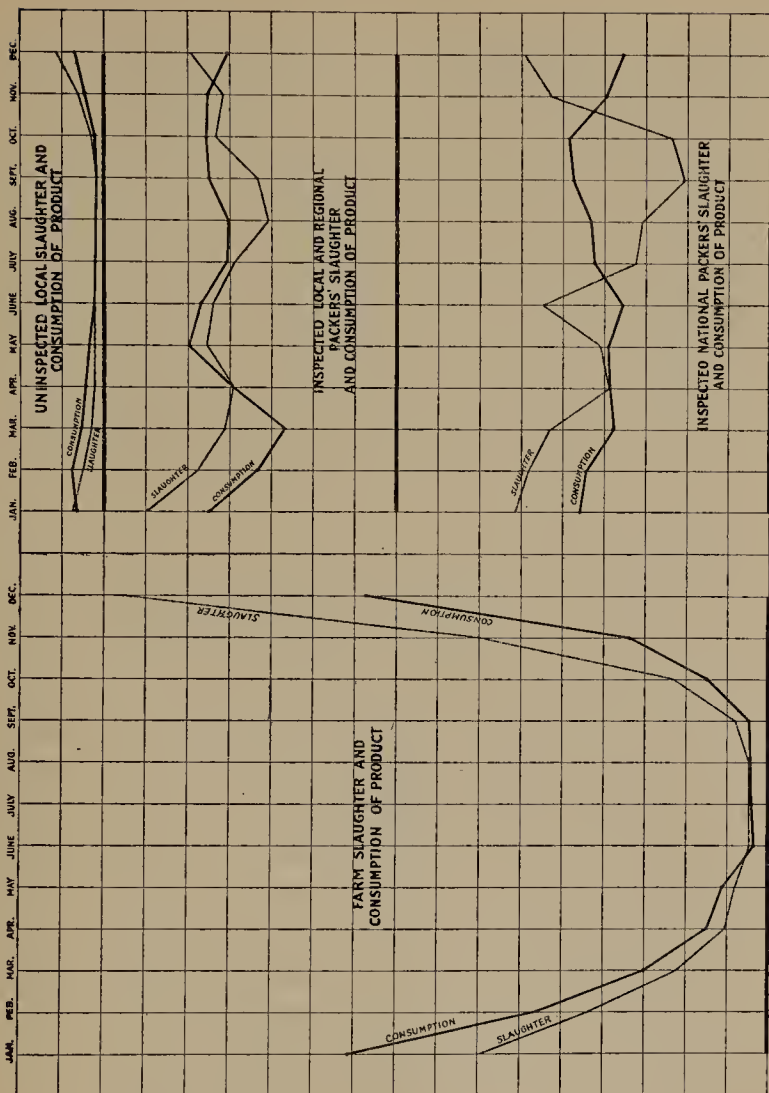
	Nov.- Dec.	Jan.- Feb.	Mar.- Apr.	May- June	July- Aug.	Sept.- Oct.
Beef and Veal:						
Production . . .	20.32%	15.15%	13.38%	13.34%	15.85%	21.96%
Consumption . .	16.02	18.34	16.07	14.95	16.60	18.02
Pork and Lard:						
Production . . .	20.14	22.21	16.35	17.93	12.52	10.85
Consumption . .	15.08	18.13	15.30	14.84	17.33	19.32
Lamb and Mutton:						
Production . . .	17.20	13.48	11.97	11.93	19.49	25.93
Consumption . .	14.70	16.67	17.21	15.60	16.22	19.60

In general, these figures show that there is a surplus production of beef and veal from September to December, as related to consumption, and a deficiency during the remainder of the year. Lamb and mutton are surplus from July through December and short during the remaining months. Pork and lard show a similar surplus from November through

June, but a very great shortage during the remainder of the year.

The relative service of distribution between different classes of slaughterers.—A better idea of this relation between a production surplus or deficiency and the rate of consumption is shown in Chart No. 1. The first curve shows that farm slaughter of hogs is confined to the fall and early winter and that the consumption of the products from them almost immediately follows. In the summer there is practically no slaughter of hogs on the farm and there is, moreover, no consumption of farm-slaughtered pork. The second curve on this chart demonstrates the same general facts for local slaughterers and butchers who operate outside of federal inspection. This curve shows that during the summer months these local slaughterers kill animals only in proportion to what they can sell, and since their distributive facilities are small, they are able to operate a straight manufacturing business. The third curve shows the condition of distribution in the local and regional packing businesses that operate under federal inspection. During the season of great market-runs of hogs they slaughter a larger volume of products than they release into the trade, while during the summer months they sell the stored products of the winter. Although in total amount of products they perform a great service to the consumer in this respect, their service to the producer is not quite as great, since they

CHART NO. 1
THE SERVICE OF SEASONAL DISTRIBUTION OF PORK AND PORK PRODUCTS



do not absorb in proportion to the peak of his production. The fourth curve shows that the point of this absorption is greatest among the national packers, that their surplus kill is greatest as related to the amount going into the trade in the winter, and that their release of product to consumers is greatest in proportion to their kill in the summer. If it were not for the national packers, to the greater extent, and for the local and regional packers, to a lesser extent, our seasonal consumption of pork, particularly fresh pork, throughout the year would correspond closely to the rate indicated under farm slaughter.

This chart shows why distribution over the seasons is necessary. If products had to be marketed to the consumer as they are produced, there would be severe gluts and corresponding low prices for raw materials during a large part of the year and severe shortages and consequently high prices during the rest of the year.

The adjustment of fresh meats to rate of consumption.
—Refrigeration is the chief means for effecting the distribution of uncured meats over the seasons. Curing and refrigeration combined operate in the case of the majority of pork products. Normally, about 10 per cent of the beef carcass and two-thirds of the hog carcass are put into a semi-permanent form by curing, freezing, etc. The rest is handled at low temperatures by the normal chill of refrigeration. Approximately 4 per cent of beef is canned, 3 per cent

cured, and 3 per cent frozen. There are two principal outlets for frozen beef, one for trimmings in sausage and the other for good cuts in the hotel and restaurant trade. Contrary to popular belief, beef carcasses cannot be put into cold storage and held for any considerable length of time unless frozen. Fresh beef is so highly perishable that it must be kept moving continuously toward consumption, and its carry-over into the months of deficient supply is brought about more by the rate of turnover than by definite storage against this time. For example, in the months when receipts are light the turnover may be as rapid as ten days to two weeks from time of slaughter to time of payment for the carcass, while during the season of heavy runs the turnover may be slowed up to as much as twenty-one to twenty-eight days. By providing suitable cooler capacity and operating the beef in strict rotation, it is possible to equalize the income and outgo somewhat along the lines of the table to which I have already referred.

Storage of cured meats.—In the case of pork, at least two months is required before cured products can be put on the market, and it is therefore the custom to use the period of heavy runs, much as the housewife uses the berry season, as the time for putting down supplies. Heavy runs of fresh pork product can be handled by putting the surplus into the freezers and holding until the market can absorb them, but in any event the products of the cold storage or the

freezer must enter trade channels as soon as they can readily be absorbed. The cost of carrying, coupled with the perishability of the article, makes it highly unprofitable to attempt to use cold storage or freezers as a means of affecting or manipulating market prices.

The manner in which the cold-storage houses and the freezers are used today to prevent disastrous market gluts stands out in contrast to the distributive machinery of one or two generations past. There was then no refrigeration, and meat had to be eaten immediately after the slaughter of the live animals or else the product had to be pickled or otherwise cured. There are many who can remember in their boyhood when meat-packing was largely a winter job, comparable to the method of farm slaughter, as shown in Chart No. 1. In fact, the industry got its name from that day, because meat was then really packed. Only territory immediately adjacent to packing-houses could get fresh meat, and that portion which could not be disposed of was pickled or salted, barreled, and piled hill-high on the prairies adjacent to the packing plants. There the product remained until the summer-consuming season arrived, and the product was distributed by the transportation methods then available. In the "good old days" of meat-packing, by far the bulk of the meat consumed was cured product, and those who were able to get fresh meat the year around were in exceptionally fortunate circumstances.

Distribution eliminates plant waste.—That was a day of meat wastes which we would not tolerate now. Hearts, livers, and various other edible products which were produced in much greater amount than could be consumed locally, and for which there was no demand in the cured state, were simply dumped into the river, fed to hogs, buried, or incinerated. Today these same products are refrigerated and handled so satisfactorily that none of them have to be wasted and all are available in all sections of the country at all seasons of the year.

Relation of distribution to permanent agriculture.—Adequate distribution of meats over the country and over the seasons has had and will continue to have a most important bearing on the nation's agriculture. The greatness of the United States is founded on agriculture, and maintenance of soil fertility is essential to the nation's prosperity. Without question, live stock is the biggest factor in the maintenance of fertility. Up until a few years ago the maintenance of fertility received relatively little attention, because so much new and satisfactory land was available that the farmer who had worn out his farm had only to move a few miles to the westward and be on a new farm.

Now practically all our arable land is under cultivation. The day of free, virgin soil is gone, and the man who has land which is producing must figure on keeping it in shape to produce indefinitely. He must

either maintain its fertility or restore fertility through the agency of commercial fertilizer.

The chief aim and purpose of farming is to produce food and clothing. Meat is a concentrate, and meat-animals were apparently intended by nature to utilize and turn into food for man those products of the fields and farms which man does not want or cannot readily use. If the world turned vegetarian, the hay crop—now one of the most valuable agricultural products—would be practically worthless. Much the same is true of the corn crop, which in dollars and cents is the most valuable crop produced in the United States. Something like 90 per cent of the corn crop is fed to meat-animals and thus indirectly to humans. What a terrible world this would be if we humans had to consume the corn and hay and oats and barley crops in their natural state instead of in the shape of good, juicy, red meat. Meat animals can turn these crops into food for humans and yet leave in the soil nearly 100 per cent of its natural fertility.

In so far as the distribution afforded by the meat-packing industry aids the farmers of specialized producing regions to turn their various crops into food for humans, it is a factor in assuring national prosperity.

there were no well-established meat-packing industry capable of distributing profitably the products of live stock in the great quantities they are produced, the foundation of our agriculture would be swept away.

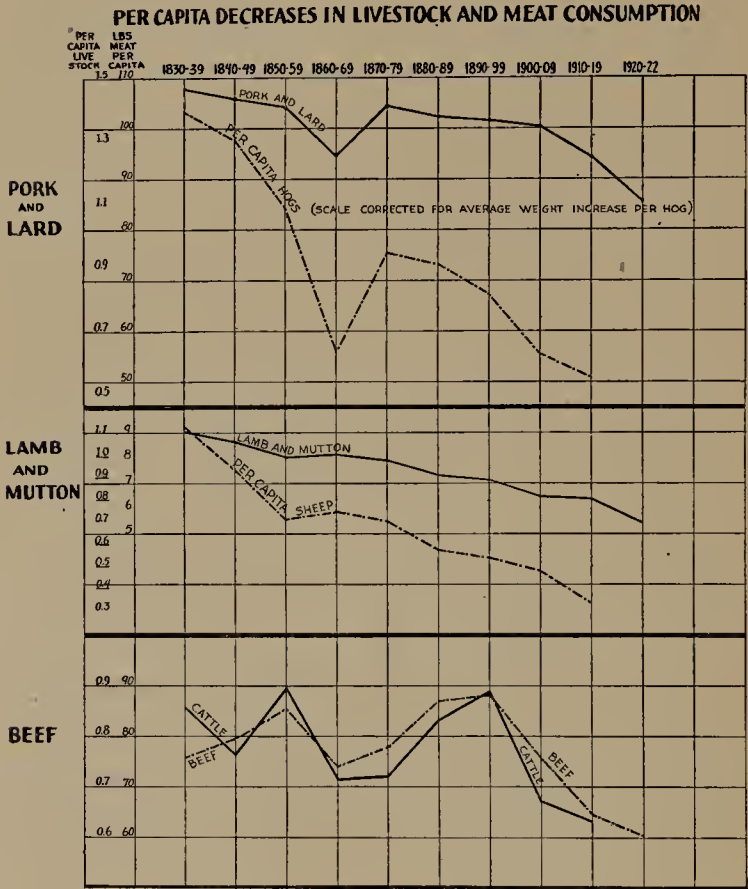
DISTRIBUTION AND MEAT CONSUMPTION

Per capita consumption of meat, therefore, has a definite relation to national prosperity. As a nation there is little prospect that we shall ever eat too much meat. In 1922 the average American consumed 149.7 pounds of meat per annum. In 1921 the figure was 143.2. Twenty years ago per capita consumption was about 180 pounds. It is not my purpose now to discuss the reasons for the decreased consumption of meat, but I do think it permissible to point out that success in efforts to increase meat consumption will be reflected in greater prosperity on the farms and throughout the country; prosperity for the moment and also prosperity for the future, growing out of properly balanced agriculture looking toward the maintenance of soil fertility.

Meat consumption has declined less than live-stock population.—One of the greatest services efficient distribution has rendered has been in the maintenance of meat consumption above the rate that would probably have developed if the packing industry had stayed on the local basis. This is represented graphically in Chart No. 2, which shows that in no class of live stock has meat consumption declined as rapidly as the per capita live-stock population. The fact is most striking in the case of hogs which have decreased on a per capita standpoint, 61 per cent, while the per capita consumption of pork and lard has decreased only 21 per cent.

The chart does not show this difference quite as strikingly as the percentages, because allowance is

CHART NO. 2



made thereon for the changes in average weight of hogs marketed. The per capita sheep population has likewise decreased 71 per cent, while the consumption

of lamb and mutton has decreased only 20 per cent. The situation in cattle is more complicated, owing to the fact that the proportions of dairy and beef cattle within the total cattle population have fluctuated considerably. As a result, the decrease in per capita cattle population and in consumption from the high point to the low point has been approximately the same, about 20 per cent.

If the record of the last twenty years is examined, it will be seen that beef tells about the same story that pork and lamb do; that is, that the per capita population has decreased more rapidly than the rate of consumption. While it is perhaps not completely correct to credit all of this advantage to distribution (manufacturing and production types undoubtedly being entitled to part of the honor), yet without the increased income resulting from efficient distribution, the experimental work necessary to improve manufacturing, and the increased investment in herds and flocks, resulting in their improvement, would not have been warranted.

EQUALIZED DISTRIBUTION FOR ALL CLASSES OF MEAT PRODUCTS

Importance of steady distribution.—The distribution of meats in the United States having been developed along the lines indicated, it has become imperative that nothing happen to interfere with the steady flow from day to day, lest famine develop in the

industrial regions. Such incidents as the railroad strikes of the last two or three years are the most demoralizing things that can occur in the live-stock and meat trade, since the cutting off of immediate sources of supply boosts the price of available meats to profiteering levels, while the cutting off of further marketing knocks the bottom out of live-stock prices and discourages the producer. Unless the steady flow of meats from west to east is maintained daily in the channels of trade, the situation becomes alarming to the consumer and ruinous to the producer. It is the fluctuation in the prospect of flow through distributive channels, as it affects the ratio of supply to demand, that causes the fluctuations in price now so irritating to the producer and packer.

Problem of slow-moving product.—Yet the flow of all classes of meat products is not at the same rate, volume of product considered, but may vary greatly, depending on the desirability to the consumer. This introduces the third problem of distribution, the fact that certain portions of the animal find a greater demand and quicker sale than other portions. During the spring and summer of 1920, following the high leather and woolen production of the war, there was little demand for hides or pelts, and there accumulated millions of dollars worth of such articles, on the basis of normal demand, that were valued on the 1920 market at approximately one-fourth of their previous price. These had been credited to the

beeves or sheep from whose backs they came as far back as February of that year, on the supposed market value the day the animals were killed, but the falling markets piled up heavy losses while storage charges continued to accumulate. In the meantime, the perishable parts of the animal, particularly the meat, were going on to the market at prices that assumed an outlet for hides and pelts similar to that of the season before. It is not necessary to review to you just what inventory losses on the slow-moving products the packing industry had to absorb.

Problem of high-priced cuts.—But these conditions were abnormal. It is only after such crises as the war that we may expect such problems to develop. Nevertheless there exist several phases of normal meat-marketing that bring up similar problems. For example, the readiest demand in our cured pork products develops for our best grade of bacon and hams. This grade of bacon can be made from only one class of hogs that possess a certain type and degree of quality. Their sides constitute only 8 to 9 per cent of their live weight, and the number of hogs of this quality is sufficiently small to reduce the figure much lower in comparison to the total kill of fresh pork for the year. In fact, if both bacon and hams of the best grade are lumped together, they constitute only about $8\frac{1}{2}$ per cent by weight of the total hog kill.

The condition is similar in other classes of animals. Loins and ribs are in greatest demand from

cattle, yet they average only 14.3 per cent of the live weight. Similarly, the saddle and legs of sheep and lambs bring the top price, but average only slightly over 31 per cent of their live weight. This makes the problem of distribution a matter of moving the less popular portions of the animal or, in relation to the live weight, 88 per cent of the hog, 85.7 per cent of the cattle, and 68.8 per cent of the sheep. The ordinary method of equalizing this situation is to price the less popular cuts so low that they will go into consumption in the proper proportions to balance up with the more popular cuts, but there are times when no market exists at all, and the problem becomes almost unsolvable. Fortunately, such a time as this, which reached its crux in 1919, occurs only once in a packer's lifetime, and he then must wait until the general economic situation of the country gives him relief, not as long a time as many of us would have predicted early in 1920.

EXPORT TRADE

Our meat surplus.—A fourth factor in distribution is the export trade in meats, hides, and animal fats. The United States has always been a surplus producing country in this particular and potentially can produce much greater surpluses than it does at present. For the eight years preceding the war, 1907-14, inclusive, our exports, less imports of all meats, including lard, averaged 619,500,000 pounds annually.

During the war years and the first year following, our average was two and a half times as great, or 1,597,600,000 pounds. Beginning with our deflation period of 1920, we have averaged 796,300,000 pounds, which is still far in excess of the pre-war period and decreased only slightly in 1922 as compared to 1921.

I quote these figures for two reasons: first, to show the potential ability of our country as a producer of exportable surpluses when need arises, and, second, to demonstrate that our agricultural and packing industries are not faced with ruin due to the shrinkage in meat exports. We are still operating on an export level, averaging 29 per cent above our pre-war level, while our 1922 level was 60 per cent above that of 1914, and our 1921 level was 57 per cent above that of 1913. Certainly, the professional alarmists who have accused the packers of wilfully destroying the export trade are woefully ignorant of the facts.

Hogs our true surplus.—Our exports in the meat trade are made up primarily of the following items:

	1922	1921
Lard.....	789,000,000 pounds	893,000,000 pounds
Pork.....	704,000,000 pounds	742,000,000 pounds
Beef.....	37,000,000 pounds	45,000,000 pounds
Mutton and Lamb..	2,000,000 pounds	8,000,000 pounds

These figures show that our true surplus comes in our pork business and that in beef and lamb our exports are almost negligible. Thirty-seven million pounds of beef business may seem a large amount to

report as negligible, but it constitutes less than half of 1 per cent of our total production, and in 1922 was almost completely offset by imports of 32,000,000 pounds.

Limit of European beef trade.—Fifteen to twenty years ago, and during the war, we did a considerable business in the exportation of beef products, running from around 300,000,000 pounds to as much as 700,000,000 pounds in a single year, but production conditions in the other principal beef surplus countries—Australia, New Zealand, South Africa, Argentina, and Brazil—have enabled them to undersell us in the European market. Another factor which has been almost impossible to overcome is found in the objection to refrigerated or frozen beef in the Latin countries of Europe, due to their desire for the blood flavor of the animal in the meat they consume. This has left Great Britain as the principal market for refrigerated beef, and price levels for cattle in this country have restricted materially our ability to compete in international commerce with the beef from these other nations. The same story might be told with regard to lamb and mutton, although our exports of this product have never been particularly important.

Export trade in animal fats.—As in previous days, America is the great source of animal fats and probably will continue to be so until our entire corn-belt capacities are required for national needs. The figures I have just quoted show that our principal export of

animal product is lard, but from the fat standpoint there may be added to it an average of 119,000,000 pounds of oleo oil, 22,200,000 pounds of neutral lard not included in the lard totals, 2,500,000 pounds of margarine, and 18,000,000 pounds of animal fat in lard compound that are strictly products of the packing industry.

While we have some competition from the cattle-surplus countries on many of the foregoing fats except lard, our fat surplus dominates the world market, regardless of whether the prices are registered in Rotterdam, Liverpool, Hamburg, or Chicago. In general, the amount of lard exported is determined by our surplus over the amount which can be absorbed in domestic commerce on a stable basis. At the close of the war, lard substitute had made sufficient inroads into the trade to make the distribution and efficient sale of lard a serious problem, but the severe depression of 1920, and the unprecedented exportation of 869,000,000 pounds in 1921, have restored normal conditions, and lard at present is working actively into the trade. At one time the depression was so severe that many apostles of corn-belt agriculture felt that the butcher type of hog best suited to the corn belt would have to be abandoned for the leaner, less lardy bacon types, but the efficient distributing system of the American packing industry relieved the pressure long before the preachments could produce appreciable effect in American herds of swine.

Export trade in hams.—Following lard, the next most important American pork product abroad is the ham. Pickled hams and shoulders are one of the few items in the American export trade which showed a decided increase in 1922 as compared to 1921. Almost 290,000,000 pounds were exported last year, the increase being nearly 60,000,000 pounds. At the time these results were developing, pickled pork other than bacon increased from something under 33,000,000 to approximately 39,000,000 pounds.

Export trade in bacon.—Bacon exports, on the other hand, decreased from 415,000,000 pounds in 1921 to 342,000,000 pounds in 1922. This last fact introduces a question that has been of public interest among American producers the last three years. Before the war the packers as a whole had some difficulty in competing on the British market with Irish, Danish, Swedish, and Canadian bacon. As Germany cut off the British markets from the Scandinavian countries, and as the Irish troubles developed, American bacon took growing hold on the British trade. In 1918 a high point was reached, but owing to bad management of the American product by the British Food Ministry and the revival of the bacon industry in competing countries, there has been a gradual decrease in the export of bellies.

British bacon demand and American products.—Many representatives of the producers have felt

that the packing industry has been overlooking a safe bet in failing to stimulate to the highest degree possible the British bacon trade. In so far as packers have been able to secure suitable hogs of bacon type, they have strained every effort to top the British market, but they have at no time been willing to take part in a movement to substitute bacon-hog production for butcher-hog production in the great hog-breeding states.

American demand determines type of American products.—American pork and provision products must in the long run be determined by American public demand. If the British demand paralleled American demand, we would have little or no difficulty in gaining a major share of the British trade. Unfortunately, the two demands differ. The ideal hog for the American trade averages about 225 pounds, is thick and symmetrical, and cuts out bacon sides weighing six to ten pounds and loins weighing eight to twelve pounds. These cuts meet the American demand both for fresh and cured products, but are entirely unsuited to the British quality market which predominantly is a bacon market. Its ideal is found in the long, deep-sided lean-streaked hog, weighing from 125 to 175 pounds alive. It is very smooth in its side, quite narrow over the top, uniform in width and depth throughout, and possessed of a fat covering approximately an inch thick and evenly distributed over the carcass. The bacon side of such

an animal contains plenty of lean meat and weighs from four to eight pounds. Denmark and Canada have particularly specialized in producing hogs suitable for this British trade. In peace times approximately 90 per cent of American pork products are consumed at home, and only some $4\frac{1}{2}$ per cent go to England, of which only a little over 1 per cent is bacon. On the other hand, in Denmark $87\frac{1}{2}$ per cent of the hog product goes to the British market and British ideals dominate the type of hog which Denmark grows.

It is obvious that our competing countries which make their principal job that of supplying bacon to a customer with well-defined tastes have a big advantage over us because we must first satisfy our own requirement as defined along other lines and then send our surplus to this British consumer. American pork products must meet this situation in attempting to capture the British bacon market, and it is extremely doubtful whether extensive effort for increased bacon sales is really worth the cost. Even if we secured the entire British import trade, we would utilize less than 10 per cent of our production, and our farmers and packers both, therefore, find it to their advantage to meet demands that today take care of 98 to 99 per cent of their product rather than to modify production to meet more exacting demands that at best would take less than 10 per cent.

DISTRIBUTION AND TRADE INFORMATION

To meet and conform to the rapidly changing condition of the market for live stock and meat products, the packer must be in closest possible contact with consuming centers, and he must have machinery for making his purchases of raw materials constantly reflect, as regards price and quality, the demand of the consuming public.

Sources of trade information.—Every well-regulated meat-packing concern arranges to have in its head office every day complete information from the consuming centers. This information is drawn from various sources. The most important source and the one most likely to govern business procedure is that based on the judgment of the representatives of each firm at the big wholesale markets. In case such representatives are not available, there are numerous organizations, such as trade papers, for example, which provide the general information as to the market and its trend. In recent years the government has attempted to provide a market service which is useful for the man who is operating away from the market, but is too slow for the firm with meat to sell at any particular hour. Supplemental information on the status of foreign trade in meats is reported by cable and appears in many of the metropolitan papers as well as in the general run of trade papers.

Trade information and prices.—On the basis of these reports and information, the general office of the firm is able to determine approximately what it can afford to pay for live stock and also the volume which it can afford to buy. All calculations are based on what may be termed average conditions and trends toward or away from the average. Furthermore, the receipts of live stock at the big markets and their fluctuations must always be balanced against the trends in the meat trade.

Fluctuations in demand.—Fluctuations in demand are almost as pronounced as are fluctuations in supply. A sudden hot wave in the East knocks the bottom out of the beef market. Housewives do not want roasts and steaks when the thermometer is around blood heat. Sudden arrivals of well-laden fishing boats at big eastern seaports usually affect the sale of meat, as do holiday supplies of poultry. The opening of the game season has a similar influence—though I must confess that my success as a hunter never tended to put any meat-packer out of business. Fast days and feast days affect the demand for meat, and there are various other factors, insignificant in themselves but powerful enough in combination, to change materially the demand for meat from day to day. This fluctuation in demand must be reckoned with in the daily management of the business.

THE GOVERNMENT AND THE PACKING INDUSTRY

It has been my purpose to confine my remarks largely to the problem of distribution, but because of my position as last lecturer in this series, I feel it is my duty to touch on one topic which does not fall specifically under any of the subjects heretofore discussed, but which is nevertheless of utmost importance to the industry.

I think it is particularly essential that we give heed to the future relationship between the government and the meat-packers. Our theory of government is undergoing a great change. Whereas earlier legislation was largely of an affirmative nature, today's legislation is primarily restrictive. The desire of Americans to unite for the promotion of the interests of the country as a whole is being supplanted by the desires of separate classes to acquire rights, privileges, or properties at the expense of other classes. The result is an increasing number of laws calculated to hamper individual and business progress and to discourage outstanding business success.

The continuing inroads of government officials into the operation and general conduct of business are symptoms of insecurity to our welfare and original ideals of Americanism that we cannot afford to disregard. Our nation's foundation is based on the principle that everyone shall have free, equal, and unlimited opportunity, but the trend of the day is

toward limitation of opportunity and a leveling of businesses and men to a point where the less competent and the less willing acquire the same rewards as do the most competent and the most willing.

Labor and agriculture and various other elements of our body politic have organized leaders in Congress and, in the two cases specified, a secretary representing them in the president's cabinet. Congress appropriates annually to promote the interests of these classes, and they possess able, if not always constructive, leadership. Business in general and the packing industry in particular has never in the past had government contact except restraint. With the single exception of the Federal Meat Inspection Act, the packing industry has never had a governmental order other than one limiting our facilities and opportunities. A hopeful sign for the future is seen in the announced policy of Secretary Hoover to build up a constructive service for commerce in general and to co-operate with existing organizations for business promotion.

Clear-thinking and forward-looking governmental leadership is needed; the government must help instead of hinder the efforts to acquaint the voting public with the necessity for concentration of capital in national industries. It must be made apparent to the public that a nation of our size and scope requires commensurate size and scope in its business and industrial activities, and it must further be made apparent that big businesses are in the interests of the

people and absolutely essential to a progressive public policy.

The commercial and industrial progress of this nation hinges on ever improving distributive facilities, and it should be the function of the government to aid in bringing about these necessary improvements. Excellent as is the distribution of meats afforded by the packing industry, there is still opportunity to make it better. That is the aim of our industry, and in that purpose it should have the helpful co-operation of the producers, the consumers, and the government.





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